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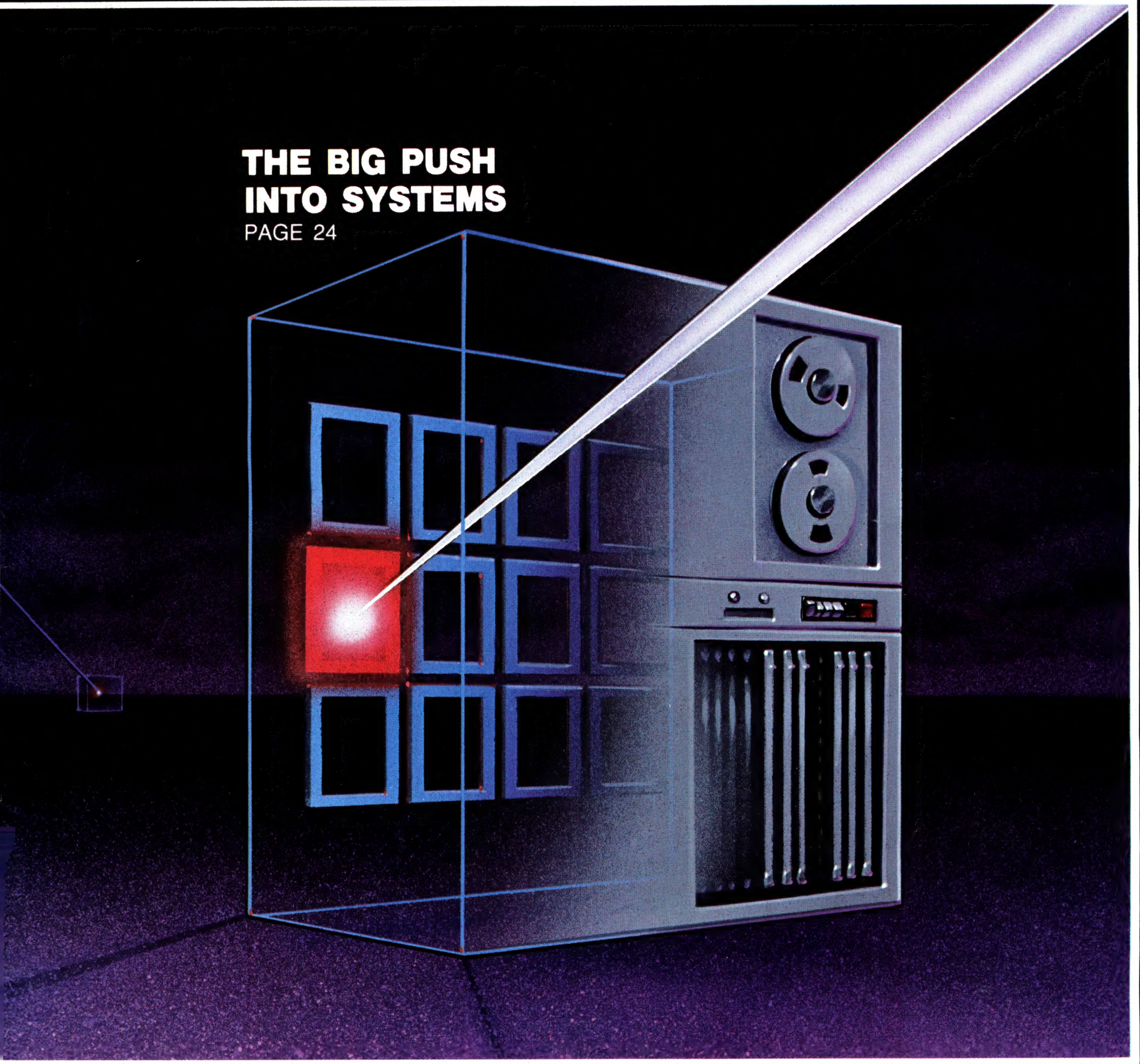

THE BIG PUSH INTO SYSTEMS
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In a major change of strategy, Japanese computer giants switch to Unix/30

U.S. relay makers, facing a growing overseas threat, seek niche markets/39

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International edition

PREVIEWS

Next ElectronicsWeek

Dream versus reality in automotive electronics

An electronics revolution under the hood and in the passenger compartment of the automobile has been optimistically forecast for a decade. Has it actually come to pass? If not, how far has it progressed and how much longer will it take to complete? There has been much talk of the new market for electronics ranging from sensors planted inside the engine to space-age displays replacing the dials and gauges of the conventional dashboard; a special report in the next issue of *ElectronicsWeek* will examine the dream and its fulfillment and answer those questions.

Communications gear continues to lighten up

The integrated-circuit revolution in telephone gear continues apace. Now designers have the opportunity to replace bulky, power-hungry equipment with a single-chip subscriber-line-interface circuit. Integrating the SLIC has been a formidable obstacle because it must be able to handle low-level voice signals as well as operate in the traditional phone world of 50-V batteries and 100-V ringers. Next week's issue describes how it was done.

Looking ahead in ElectronicsWeek

How far off is the turnaround for the electronics industry?

Last year's industry forecasts for 1985, especially in the bellwether semiconductor sector, tended to be optimistic. Now the industry is locked in the grip of a slump, and electronics companies are repositioning themselves to deal with the conditions by changing strategies, adjusting inventories, putting off capital expenditures, laying off workers, and doing whatever else is necessary. The midyear market report in the June 24 issue will examine what is being done and when insiders expect the picture to improve.

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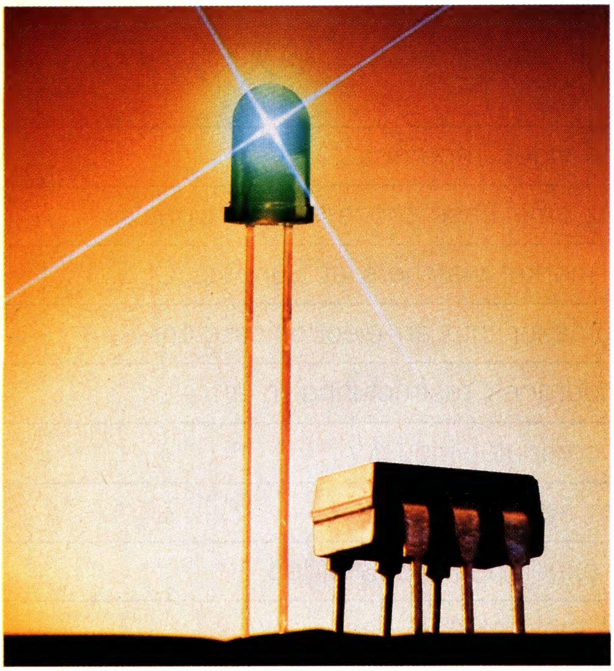

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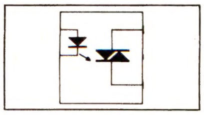

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APPLE TRIES TO REGAIN SHINE

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Operating Systems Disenchanted with barriers posed by IBM, Japanese computer manufacturers are turning to Unix for a standard **30**

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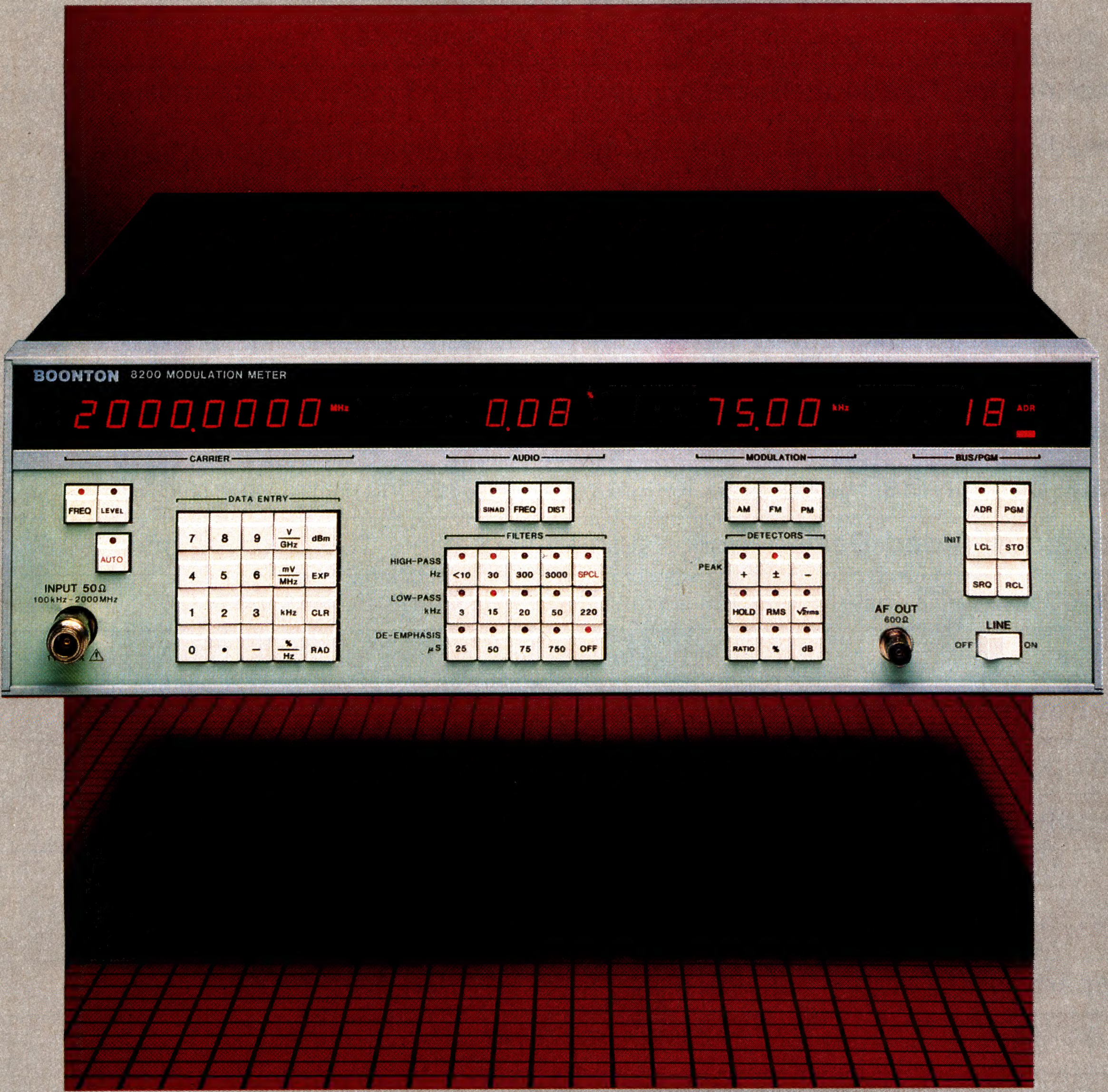

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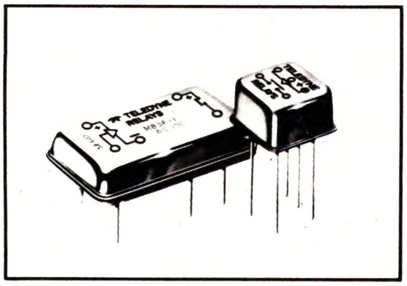

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MEETINGS

How to Increase Profits Using Advanced Manufacturing Technologies, Computer Aided Manufacturing International Inc. *et al* (CAM-I, 611 Ryan Plaza Dr., Arlington, Texas 76011), Americana Hotel, Fort Worth, Texas, June 18-19.

Satcom '85, Institute for Graphic Communication Inc. (375 Commonwealth Ave., Boston, Mass. 02115), Stouffer's Conference Hotel, Arlington, Va., June 19-21.

World Computer Graphics '85 Exposition and Conference, World Computer Graphics Association and the National Computer Graphics Association (American Communications Group, 8300 Greensboro Dr., Suite 690, McLean, Va. 22102), New York Coliseum, July 10-12.

Computex Taipei '85, China External Trade Development Council (Taipei Sungshan Airport, Taiwan, Republic of China), CETDC Exhibition Complex, Taipei, Taiwan, July 12-18.

National Computer Conference, American Federation of Information Processing Societies (1899 Preston White Dr., Reston, Va. 22091), McCormick Place, Chicago, July 15-18.

IBM Futures: The Next Ten Years, Gartner Group Inc. (72 Cummings Pt. Rd., Stamford, Conn. 06904), Westin O'Hare Hotel, Chicago, July 18-19.

International Symposium on Microwave Technology in Industrial Development, Brazilian Microwave Society (Jose Giarola, Telebrás Research & Development Center, 13100 Campinas, São Paulo, Brazil), Telebrás Research & Development Center, São Paulo, Brazil, July 22-25.

Siggraph '85—Twelfth Conference on Computer Graphics and Interactive Techniques, Association for Computing Machinery and IEEE (Siggraph '85, Services Office, 111 E. Wacker Dr., Chicago, Ill. 60601), Moscone Convention Center, San Francisco, July 22-26.

Financial Information Systems—Integrating Personal Computers, National Institute for Management Research (P.O. Box 3727, Santa Monica, Calif. 90403), L'Enfant Plaza Hotel, Washington, July 24-26.

The 1985 Hardened Electronics and Radiation Technology (HEART) Conference, Science Applications Inc. (J.P. Retzler, Science Applications Inc., 501 Marin St., Suite 200, Thousand Oaks, Calif. 91360), Naval Postgraduate School, Monterey, Calif., July 25-26.

Seminars

Surface-Mount Assembly Production Facilities: Advanced IC Packaging Technologies, International Electronics Packaging Society (P.O. Box 333, Glen Ellyn, Ill. 60138), Bayside Exposition Center, Boston, June 18.

S-6 ISDN Markets, Information Gatekeepers Inc. (214 Harvard Ave., Boston, Mass. 02134), Hyatt Regency Crystal City, Arlington, Va., July 9.

Networking, Protocols, and Compatibility, Datapro Research Corp. (1805 Underwood Blvd., Delran, N.J. 08075), Marriott at Fisherman's Wharf, San Francisco, July 15-16.

Principles of Microcomputers and Microprocessors, University of Michigan (College of Engineering, Chrysler Center/North Campus, Ann Arbor, Mich. 48109-2092), University of Michigan, July 15-19.

Computer-Aided Optimization in Engineering Design, Union College (Graduate and Continuing Studies, Wells House, 1 Union Ave., Schenectady, N.Y. 12308-2363), Union College, Schenectady, N.Y., July 15-19.

AT&T's Software Defined Network and Alternatives, The Yankee Group (89 Broad St., Boston, Mass. 02110), Watergate Hotel, Washington, July 16-17.

Gateway to the Future, Intel Corp. (5000 W. Williams Field Rd., Chandler, Ariz. 85224), Bellevue Hilton, Bellevue, Wash., July 17.

Maintenance Management Seminar, University of Kentucky (Office of Continuing Education, College of Engineering, 223 Transportation Bldg., Lexington, Ky. 40506-0043), Campbell House Inn, Lexington, Ky., July 18-19.

Advanced Technologies and Marketing Strategies for Local-Area Networks, Technical Marketing Society of America (Technology Training Corp., P.O. Box 3608, Torrance, Calif. 90510-3608), Hyatt Regency Cambridge, Boston, July 15-16; Marriott Twin Bridges, Washington, July 22-23.

Cellular Radio-System Operation, University of Wisconsin Extension (432 N. Lake St., Madison, Wis. 53706), University of Wisconsin Extension, Madison, Wis., July 24-26.

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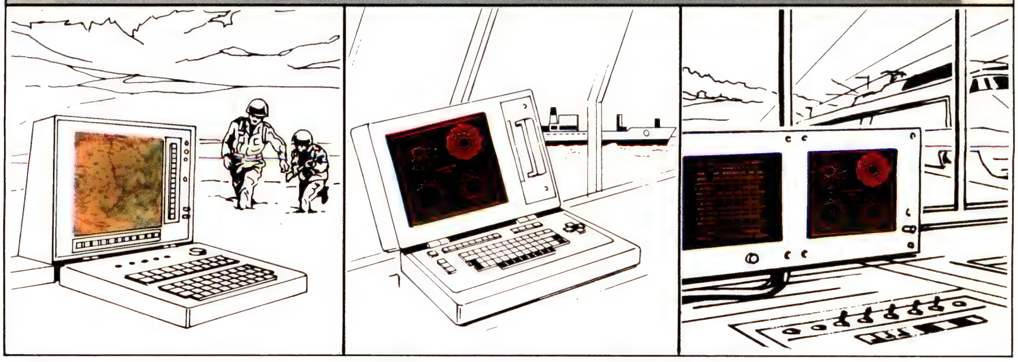

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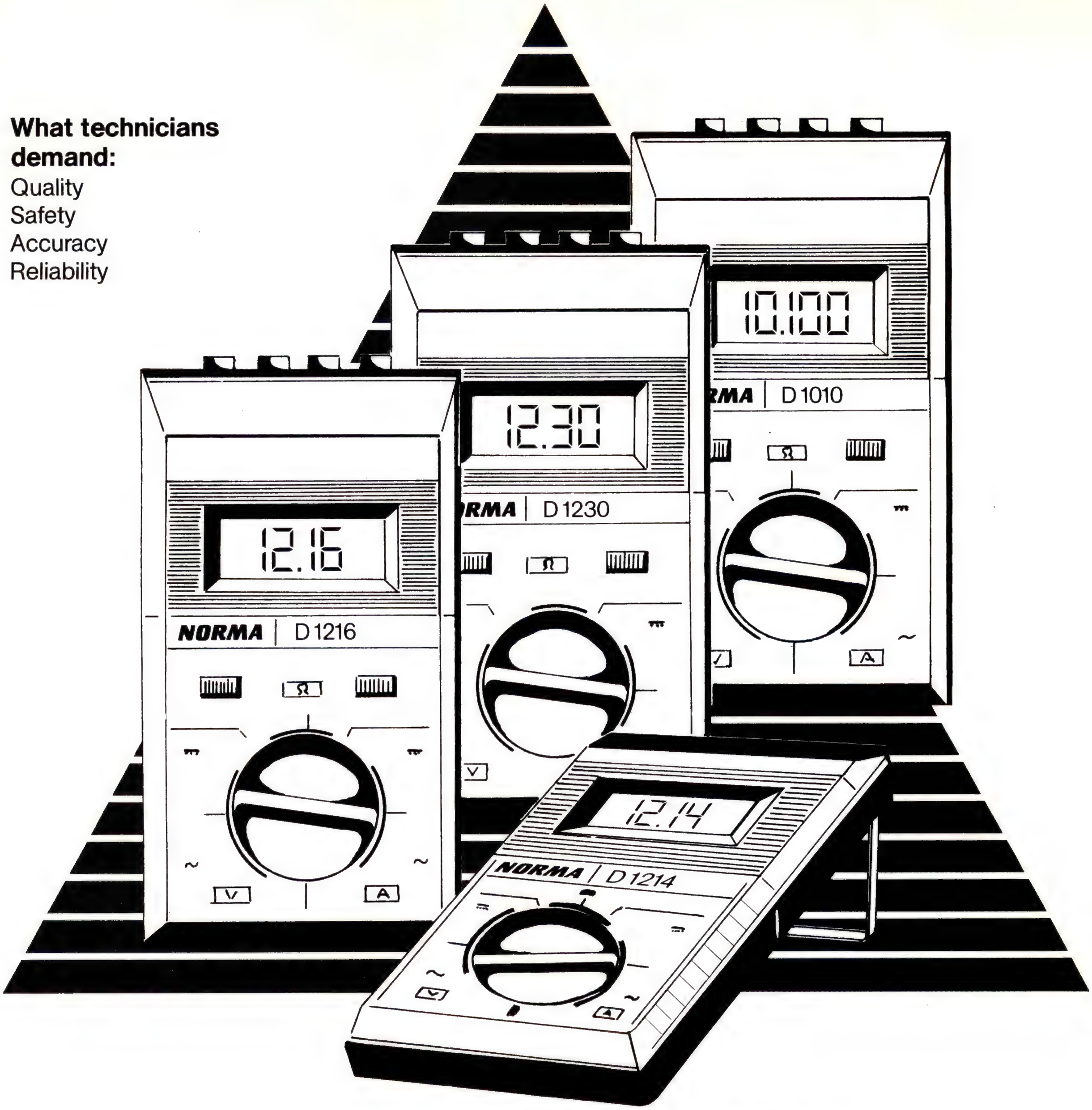

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THIS ElectronicsWeek

THURSDAY *May 30*

IBM Corp. said earnings growth was unlikely for its second quarter, and a decline is probable. IBM's first-quarter earnings tumbled 18% for the computer giant's first quarterly decline in more than three years. Blaming the strong dollar for "masking good performance overseas" and sluggish growth in the gross national product at home, a spokesman declined to attribute Big Blue's poor performance on weakness in the computer industry. IBM is confident that earnings will start to climb again late in the year. It is pinning its hopes for renewed vigor and earnings growth for the full year on sales of its Personal Computer line—which the company says are up over a year ago—and the much-heralded Sierra, or 3090 mainframe computer, which is scheduled to ship in the fourth quarter.

FRIDAY *May 31*

Dataproducts Corp. said it is consolidating its worldwide forces in an attempt to weather the storm of hard times that is battering the computer industry. The Los Angeles printer manufacturer, which has already laid off about 700 workers since the beginning of the year, is **closing its Irvine, Calif., facility and planning to trim its 5,000-member labor force by 700 to 800 direct laborers** before the end of July. "Business is terrible," a spokesman said.

MONDAY *June 3*

Attendance at the Summer Consumer Electronics Show topped 98,000 by the second day, equaling last year's total for all four days of the annual Chicago event. And a first tally of this year's total showed 102,000 passed through the turnstiles, which show sponsors say tops the previous record of 101,000 set at the winter show last January in Las Vegas. Both the number of exhibitors and total exhibit space were off slightly at the show, however, reflecting softness in the home computer market.

TUESDAY *June 4*

A meeting of research ministers from member nations of the European Communities held in Luxembourg put its weight behind an EC project today for a **Europe-wide broadband telecommunications network.** The meeting stopped short, however, of the action most observers expected it to take: formally approving the first phase of the program designated RACE, for research and development in advanced communications technology in Europe. Final approval, however, is expected before the end of this month. The same meeting also expressed support for the French-backed Eureka research program that French president François Mitterrand has proposed as an alternative to the Reagan Administration's Strategic Defense Initiative, or Star Wars program.

WEDNESDAY *June 5*

Wang Laboratories Inc. announced that it had laid off 1,600 workers and would report a loss for its fourth quarter ending June 30. The company would not speculate on the amount of the loss—**the first quarterly loss in more than a decade**—but said it still expected fiscal 1985 to be profitable. The layoff is also the first in more than a decade. . . . Adept Technology, Sunnyvale, Calif., today introduced a new assembly cell for through-hole and surface-mounted electronic boards at the Robots 9 conference in Detroit. It is already reported to be **the fastest assembly robot working for the electronics industry** [*ElectronicsWeek,* Dec. 10, 1984, p. 34]. ☐

8.

Meets high technical requirements made nowadays on dual-in-line relays

7.

Low power consumtion

Extremely low power consumtion of only 75 mW without fixed polarity of current means a lower circuit power demand and less heat dissipation.

6.

Broad switching range

Reliable switching from low-level signals to 150 V/1.25 A at 30 W/50 VA, also withstanding cable discharge.

5.

Dielectric strength

Increased protection of circuitry and systems by resistance against surge voltage of 1500 V (10/700 µsec) or 1000 V (1.2/50 µsec).

4.

Broad ambient temperature range

Wide application range at ambient temperatures from −55 °C to 70 °C.

3.

Modular design

Increased reliability by effective intermediate operational checks during production process.

2.

Easy workability

Meets broad range of soldering equipments and automatic washing process thanks to solderability of 10 sec/260 °C or 3.5 sec/350 °C and seal integrity for 10 min/75 °C or 20 sec/125 °C.

1.

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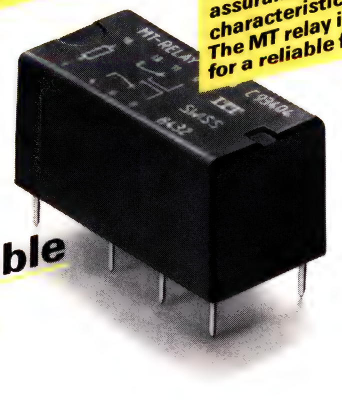

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UP FRONT

U.S. willing to move against Hitachi America over chip dumping

The U.S. government is prepared to take legal action against Hitachi America Ltd. for what one official calls "predatory pricing of erasable-programmable read-only memory (EPROM) products in the U.S., designed to win market share at any cost." No U.S. semiconductor manufacturer has yet filed a formal complaint with the Commerce Department, but a U.S. official in Tokyo said that if such action was forthcoming, "we think we'd have a pretty strong case."

The uproar follows the revelation of a marketing memo in which a Hitachi marketing manager directed distributors to "win with the 10% rule. . . find AMD [Advanced Micro Devices Inc.] and Intel sockets. . . quote 10% below their price [and] if they requote, go 10% again. . . don't quit 'till you win!" The memo, written a few months ago, also guaranteed distributors a 25% profit margin. In the U.S., Intel Corp. president Andrew S. Grove, whose firm invented the EPROM, charged that Hitachi was exploiting the semiconductor market slump to cause U.S. companies "permanent, long-lasting damage."

After the story broke in Tokyo last week, Tsuneo Tanaka, newly appointed president of Hitachi America Ltd., maintained at a press conference in New York that the memo, written in late February by a Hitachi employee in San Jose, Calif., was rejected within a week as being contrary to policy. It "in no way reflected our company's marketing strategy. . . and was rescinded as soon as I became aware of its existence," he added.

Underlying the fracas are steep drops in EPROM prices over the last several months. U.S. market prices, according to figures provided by a Commerce Department official in Tokyo, have fallen from close to $20 for a 256-K product a year ago to about $4.50 now. In Japan, industry sources say, prices have plummeted from about $8 per unit for a 128-K product last year at this time to as low as $2.50. Upper-end 256-K products that sold in Japan for close to $40 last summer are now selling for about $5. Said a U.S. semiconductor executive in Tokyo who asked not to be identified, "Hitachi is the major force which has been driving those prices down."

Hitachi, though, says these figures aren't accurate for its products and claims that prices are generally higher in the U.S. than in Japan. And it maintains that the U.S. official is wrong about having a "strong case" regarding predatory pricing. However, Hitachi would not comment on exact pricing, saying it varies from day to day. Industry sources in Japan predict that the losers will not be the major U.S. players, but newcomers to a market valued last year at $1.17 billion worldwide. Intel led the 1984 market with a 17% share, followed by Hitachi and AMD, both at 14%. Third place went to Mitsubishi Electric Corp. with 13%. Texas Instruments and Fujitsu tied for fourth place at 11%. ☐

VHSIC technology improves 1750A military microcomputer

The first military standard computer to use improved device technology from the Pentagon's Very High-Speed Integrated Circuit Phase I program will be the Air Force's widely used 1750A 16-bit unit. A team from the Military Electronics division of TRW Inc. and the Delco Division of General Motors Corp. will develop the modular, fault-tolerant computer based on two CMOS central processing units. Running at more than 3 million instructions per second, it will be more than four times faster and 50% smaller than current 1750 processors, the companies claim. As part of the modular design (which includes built-in test nodes on every chip), the computer will detect and isolate hardware failures and reconfigure itself. TRW's VHSIC partner, Motorola Inc.'s Semiconductor Products Sector, will fabricate the CMOS chips. Under terms of the four-year contract, delivery of 11 breadboards will begin in the fourth quarter of 1986, with 20 advanced models to follow a year later. ☐

UP FRONT

Cray Research formally announces Cray-2

With delivery of the first fully configured Cray-2 multiprocessor system to the Lawrence Livermore National Laboratory, supercomputer leader Cray Research Inc. last week formally announced the debut of its newest machine, serving notice to Japanese competitors and others that it intends to stay out front in the race to supply the world's fastest commercially available computers. The Cray-2, whose design team was headed by the firm's founder, Seymour Cray, relies on four identical background processors working with a foreground processor for data-flow coordination to achieve theoretical peak operating speeds of 1.2 billion floating point operations per second. Billed as 6 to 12 times faster than the original Cray-1, the $17.6 million Cray-2 system, which operates under AT&T Bell Laboratories' Unix, runs at about the same speed as the company's current four-processor X-MP/48 [*Electronics-Week,* July 23, 1984, p. 40]. However, Cray officials say the two machines address different kinds of problems. Cray plans to deliver two additional full-blown Cray-2s this year. Meanwhile, Seymour Cray is at work on the next-generation Cray-3 system, to be built using gallium arsenide chips. ☐

Intel agrees to second-source Altera's CMOS programmable logic devices

Tiny Altera Corp., a Silicon Valley startup that hopes to catch the marketing wave for CMOS programmable logic devices, got a big boost last week when its giant Santa Clara, Calif., neighbor, Intel Corp., agreed to second-source Altera's 1,200-gate part. The move marks Intel's debut in the logic market. The parts are targeted at the low-end gate-array market, where they offer users a chance to buy standard products and bypass the mask process. Intel's entry, says Altera president Rodney Smith, "will really solidify our position in the [electrically programmable logic] market," which he estimates will hit $2 billion by 1990. Intel acquired second-sourcing rights last year in exchange for letting Altera use its high-speed CHMOS process. Intel also has the rights to use Altera's programming software, which is regarded as a key to the use of user-programmable logic. ☐

AMD's EPROM-based microcomputers shorten programming time

Availability of single-chip microcomputers with a large amount of on-board erasable programmable read-only memory is growing, but so is the time it takes to load software into the ultraviolet-light-erasable PROM. Advanced Micro Devices Inc. is announcing this week two new 8-bit microcomputers—one with 8-K bytes of EPROM, the other with 4-K bytes—that can be fully loaded with software in about 7% of the time it takes to program conventional UV-erasable chips. Using an adaptive-device programming algorithm (sometimes called interactive or intelligent programming), the 8-K bytes of EPROM in the Am9761AH can be set in 24 s, compared with 6½ min using conventional techniques. ☐

Scottish firm brings out six Pascal compilers

Lattice Logic Ltd., the Edinburgh firm best known for its silicon compiler, has found a new outlet for its software skills in Pascal compilers. Each is validated by the British Standards Institution in a pilot scheme that could form the basis of a worldwide service. The target machines for the first six are: the Digital Equipment Corp. VAX running under VMS and Unix, the Perkin-Elmer 3200 running under OS32 and Unix, Whitechapel Computers Ltd.'s MG-1 running under Genix, and Acorn Computers Ltd.'s NS 32016 processor running under Panos. To follow are compilers for Apollo Domain and Sun Microsystems work stations, the Intel 286, and IBM 4300 machines. ☐

INTERMETALL CHIP KIT DIGITIZES VIDEO RECORDERS

Two chips—one CMOS, one bipolar—and a quartz time base process VCR signals

Freiburg, West Germany

When it comes to video cassette recorders, smaller is beautiful. So maintains Intermetall GmbH, lead house of the ITT Semiconductors Group.

Last week at the International Conference on Consumer Electronics in Chicago, the chip maker backed up that contention with details on a forthcoming two-chip set that will digitize VCR circuitry, meaning smaller hardware and cleaner images on playback. The chips can be applied to video recorders of any format—VHS, Beta, or Video 2000—and are designed to meet any of the three common color-system standards—NTSC, PAL, and Secam.

"For us, applying digital techniques to video recorders is a logical step in our efforts to digitize entertainment electronics equipment," says Sönke Mehrgardt, leader of the digital VCR project. This step follows ITT's much-discussed Digit 2000 system, a multicircuit chip set that digitizes all video and audio functions between a color TV receiver's demodulator and output stages [*ElectronicsWeek*, April 29, 1985, p. 32].

With the new, as yet undesignated, two-circuit chip set, all video signal processing is performed in a video processor chip, a 40-mm^2 very large-scale integrated circuit using 2-μm CMOS technology. The other chip, a 20-mm^2 bipolar device, carries the necessary analog-to-digital and digital-to-analog converters. The chip set needs only one external component: an 18-MHz crystal to supply the clock for the three color-TV standards.

Engineering samples of the two-chips-plus-one-crystal solution should be available in about a year. The converter chip is already in silicon; the video processor is well along in design, ITT reported at the conference. Thus, ITT Semiconductors figures it may well be the first firm to market with a digital solution for VCRs, just as it was for receivers with the Digit 2000 chip set.

Laden with benefits. Digital signal processing "provides more benefits in a video recorder than it does in a TV receiver," Mehrgardt explains. A VCR, for example, needs several delay lines (a TV receiver has just one) and precisely tuned filters to handle its signal processing. Digital techniques eliminate the filters and make it much easier to control the delays, thus considerably simplifying signal processing.

Furthermore, to make them as compact as possible, VCRs have densely packed circuit boards. The chip set cuts the components count "by several hundred devices, depending on VCR design," Mehrgardt maintains. The cut lowers power requirements for the hardware and the CMOS technology of the video processor circuit further reduces power needs.

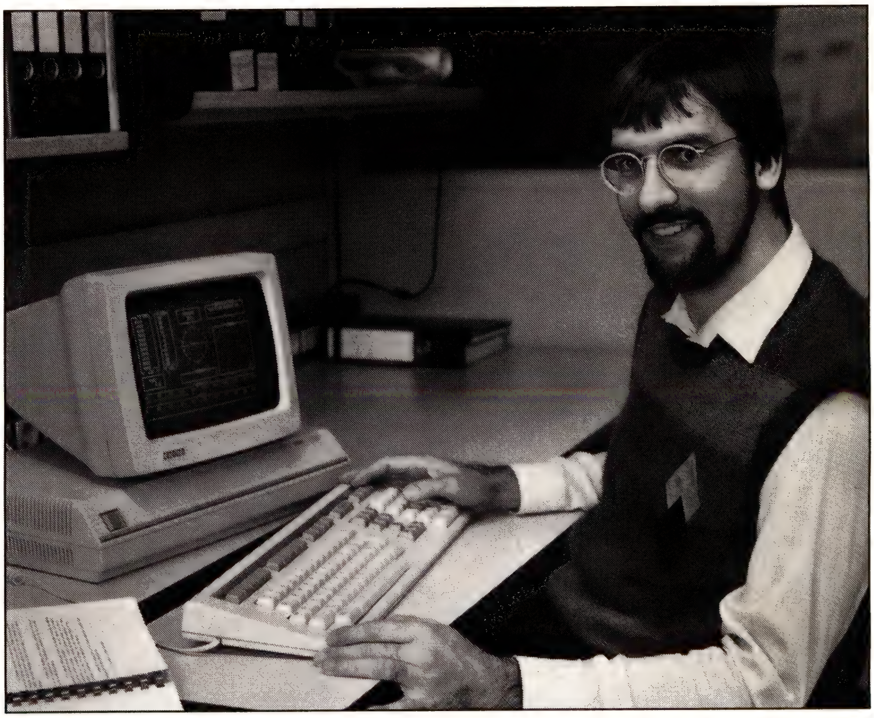
With a digitized TV receiver, the viewer does not spot the advantages immediately; but a digital VCR has benefits that are discerned right away. The TV screen has less jitter, fewer dropouts, and less noise—in sum, a better picture. Digital methods more readily implement time-base correction (to compensate for jitter), dropout compensation, and adaptive noise suppression than do analog methods.

With digital techniques, other improvements are possible that are too expensive with analog circuits. For example, they can turn an NTSC/PAL/Secam multistandard recorder into a relatively inexpensive piece of equipment. The same goes for a standard-conversion recorder, one that can play back, say, a Secam tape on a PAL TV set.

As for chip cost, at this stage of development, ITT Semiconductors cannot give an exact figure for its digital approach. "But with the chip set expected to sell for less than $20, we are confident we can beat the cost of an analog-circuit solution by far, although the latter has drastically come down in price in recent years," Mehrgardt says.

Pair of problems. Several chip makers, primarily in Europe, have proposed and investigated digital signal processing in VCRs. ITT came up with a workable solution when it solved two key problems: designing a good digital frequency demodulator and arriving at an economical color signal-processing concept for all standards: NTSC, PAL, and Secam.

Used in the playback mode, the demodulator must operate with the fixed 18-MHz system clock and demodulate the tape signal using a 4-MHz carrier frequency and a 3-MHz bandwidth. It must also be insensitive to amplitude variations. These requirements are fulfilled with a demodulator circuit that borrows somewhat from the design of



Digitizer. Sönke Mehrgardt leads the ITT Semiconductors team that is digitizing VCR circuitry by means of just two circuits: a bipolar converter and a CMOS video processor.

the Secam processor of ITT's Digit 2000 chip set.

The frequency-modulated input fed to the demodulator is split in a phase splitter into two signals. These are 90° out of phase with respect to one another. A divider and a read-only memory with an inverse tangent table evaluates the angle of the quadrature signal generated by the phase splitter. A differentiator finally delivers the demodulated output.

Crucial to good demodulator operation is the broadband phase splitter. It can easily be implemented in digital form. The phase shift between the signals is exactly 90° degrees and the amplitude variations in the 1- to 7-MHz range are negligible. The demodulator occupies only a few square millimeters on the 40-mm^2 video processor chip.

Chroma frequencies. The biggest problem in color signal processing arises from the different chroma frequencies used in the three color standards. In both recording and playback, each system uses different frequency ranges, meaning the chip set must have six different filters for separating the luminance and chrominance signals.

To avoid the complex switching necessary for a digital filter, the ITT designers are using two quadrature mixers. One shifts the color carrier of the input signal to one quarter of the 18-MHz clock—that is, to 4.5 MHz. The color signal is processed at this new frequency, which is the same for both recording and playback. The other mixer changes the signal to the final output frequency. Signal processing includes automatic gain control, phase stabilization, and crosstalk compensation. *–John Gosch*

CONSUMER

SMALL CD PLAYERS CALL TUNE AT CES

Chicago

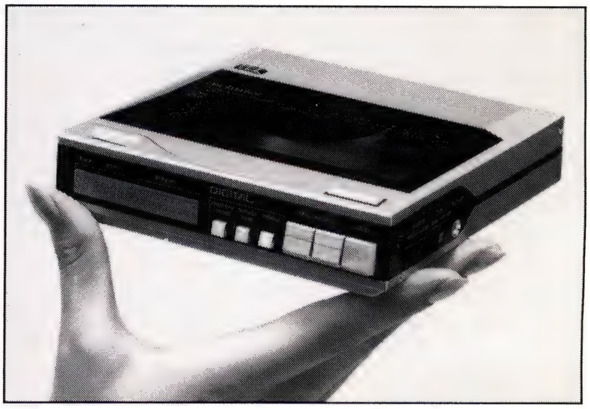
After years of taking a back seat to more glamorous video products such as the video cassette recorder, the audio industry has rather suddenly developed its own new technology darling.

"The compact disk has made its move right into the mainstream in a staggeringly short time," observes Leslie Rosen, director of the Compact Disc Group, a two-year-old trade organization formed to foster awareness of the laser-based digital audio format.

Indeed, according to figures released at last week's Summer Consumer Electronics Show, CD hardware sales in the U.S. are expected to nearly triple this year to 600,000 units, up from just 35,000 digital disk players sold when the technology made its U.S. debut in 1983.

"This category is growing so fast that industry experts anticipate shortages and back orders by year's end—especially at the low end," observes William E. Boss, an RCA Corp. executive and vice president of the Electronic Industries Association's Consumer Electronics Group. The organization projects another 50% jump in growth next year to 900,000 units, which is close to the 1 million-unit benchmark that is sometimes cited as hailing the arrival of a mass market for a consumer electronics product category.

Even more impressive is the growth in CD software sales. With an estimated 2,800 titles now available on the standard 4.7-in. disk format, unit sales jumped from about 800,000 in 1983 to 5.8 million last year, according to the Recording Industry Association of America. An estimated 4,000 titles are expected to be available by year-end, and the Compact Disc Group projects sales of 15 million disks this year.



Handful of sound. Matsushita Electric bills its portable compact disk player as the world's smallest. Playback system of the unit is based on a single-laser pickup.

With a market size in factory hardware sales expected to top $230 million by next year, CD player prices have been falling like a rock as manufacturers jockey for a leading market share. A number of major vendors including Sony, Technics, Pioneer, Magnavox, and Sanyo showed low-end players at the CES with suggested retail prices of about $299, and street prices on some units are expected to hit $199 or less by the Christmas buying season. That's down from suggested retail prices of $800 to $1,200 at product rollout in 1983 [*Electronics,* Jan. 27, 1983, p. 52].

One vendor went even further. Symphonic Corp., Compton, Calif., unveiled

EIA EXPECTS VCR SALES TO KEEP SOARING

While the compact disk is busy adding new glitter to the audio side of the U.S. consumer electronics industry, the video side of the business continues to be paced by heady growth in the shipments of video cassette recorders. This follows last year's steep 86% rise to a record 7.6 million units. In figures released at last week's Summer Consumer Electronics Show in Chicago, the Electronic Industries Association's Consumer Electronics Group projected an additional 51% leap in VCR factory sales this year to 11.5 million units. That's an upward revision from the 9.5-million VCR unit-sales mark projected for 1985 by the EIA's consumer group at last January's CES in Las Vegas.

Part of the reason for the expected continued sharp upward growth is falling VCR prices; the average wholesale per-unit factory selling price expected to drop from $455 last year to $421 in 1985. "Both this year and next year, VCR sales will approach $5 billion in factory dollars, or about $7 billion at retail, almost the equivalent of color-TV dollar volume," says William E. Boss, vice president for the trade group. VCRs are currently in an estimated 23% of U.S. households. Boss points out that current VCR numbers only begin to reflect the potential impact of the new 8-mm format that showed growing support at CES.

Led by VCRs, the video segment of the industry is expected to grow by 8.9% this year to $11.2 billion, outpacing audio product sales growth of about 7.4% to $6.7 billion. In total, U.S. consumer electronics product factory sales for all categories this year are projected to grow by 2.8% to $23.6 billion, which translates to more than $32 billion at retail. **–W.R.I.**

its first CD player in Chicago at a $179.95 suggested retail tag. "We think prices will erode rapidly and we're trying to grab a share of the market right now. Why fool around?" explains Donald D. Hockett, Symphonic's operations manager. "By 1986, I predict the industry will probably be able to retail CD players for $100."

Show stopper. Technics, an affiliate of Matsushita Electric Industrial Co., grabbed a major share of the CD spotlight in Chicago with the introduction of several models, including a $300 portable player positioned against archrival Sony Corp.'s highly successful $299.95 D-5 portable player, introduced in January at the Winter CES in Las Vegas.

The Technics player, called the SL-XP7, measures 4.96 by 1.26 by 4.96 in. and is billed as the world's smallest CD player. It features a miniaturized single-beam laser pickup system that, claims Technics senior product manager Paul Foschino, tracks better than the three-beam system used in the Sony D-5. Technics' unit also boasts 15-step random-access programming.

Matsushita plans to have its new entry on the market in August. Meanwhile, Sony will be looking for market share with several new CD players of its own, shown off last week at a Chicago hotel suite, including a one-piece portable that features an integrated cassette deck, an AM/FM stereo tuner, a five-band equalizer, and detachable speakers.

In all, Rosen of the Compact Disc Group estimates, some 35 hardware vendors have jumped on the CD bandwagon, which is based on the industry-standard format developed by Sony and N.V. Philips of the Netherlands. Thanks to its digital recording technique, the CD technology offers improved sound compared to conventional long-playing records: dynamic range extends to about 90 dB, for example, compared to perhaps 60 dB on the best analog records. In addition, the optically read CD never suffers needle wear.

No one is predicting that the new digital audio format will make LPs obsolete any time soon, however. An estimated 80 million conventional LP turntables are currently spinning in U.S. households, and LPs still represent some 40% of major music-marketing companies' business, compared with a mere 4% for CDs, says Rosen.

But Boss, for one, predicts that by next year, new CD releases will exceed those of both LPs and cassettes. "This doesn't mean that record companies are going to stop selling LPs," says Rosen. "It just means that time is the LP's greatest enemy. *–Wesley R. Iversen*

COMPANIES

HUGHES BUY TURNS GM INTO ELECTRONICS GIANT

New York

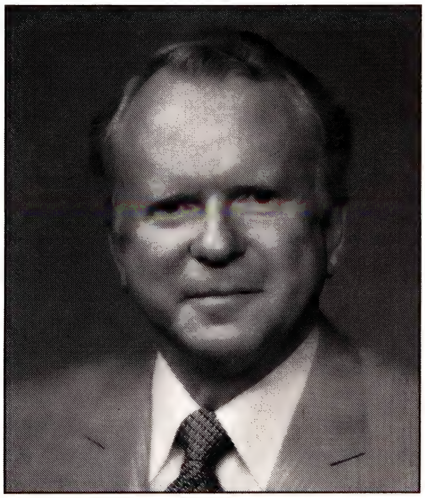
General Motors Corp. last week won the bidding battle for Hughes Aircraft Co., and the automaker plans to merge the defense-electronics company with its other electronics operations to form what could be the second largest electronics entity in the U.S.

Trustees of the Howard Hughes Medical Institute, the owner of Hughes Aircraft, accepted GM's offer, valued at over $5 billion, for Hughes. GM offered $2.7 billion in cash and 50 million shares of a new Class H common stock.

GM will form a new unit, GM Hughes Electronics Corp., which will own Hughes Aircraft. GM will also transfer the assets of its Delco Electronics Division, the AC Spark Plug Division's Instrument and Display Systems Business unit, and Delco Systems Operations to a new unit of GM Hughes Electronics called Delco Electronics Corp.

As big as Hughes Aircraft is (with 1984 sales of about $5.8 billion), Smith said the Delco assets being transferred to GM Hughes Electronics also total about $5 billion. This almost $11 billion organization would trail IBM Corp. but could be larger than the electronics operations of AT&T Co.

According to GM chairman Roger B. Smith, the addition of Hughes fills a major void in his company's technology base and will help propel GM into the forefront of the international automobile market as well as lead it into new electronic areas. "We had been looking at Hughes longer than they had been for sale," Smith said.


High bidder. GM chairman Roger B. Smith says Hughes Aircraft is "exactly what GM needs to get where we want in the future."

Hughes, Smith said, is "exactly what GM needs to get where we want in the future. Hughes and EDS give us a solid base for the future," he continued, referring to Electronic Data Systems Corp., which GM bought last October for $2.55 billion in cash and stock.

Smith said GM has no plans—"not today," at least—to buy any other big companies, even if they were available. "I haven't seen anything as big as Hughes lying around out there," he said. On the other hand, he noted that there may be some additional niches to be filled in GM's strategy. "Certainly we'll look at further developments. There are still some pieces" that GM can add, he said.

GM has been actively investing in high-tech in recent months, buying part of artificial-vision technology companies Automatix, Difracto, and View Engineering [*ElectronicsWeek*, Aug. 13, 1984, p. 11]. It also bought a piece of knowledge-base expert-system firm Teknowledge Inc.

Smith hopes GM Hughes Electronics can put GM at the top of the international automobile marketplace in the future. "The automobile has a fantastic future," Smith said, projecting a 60-million vehicle worldwide market in the 1990s. "For that you need the best product. For that, you need electronics. Hughes can be a tremendous help in research and development and new products."

But Smith recognizes he is buying more than just an in-house development tool. "We think we can help Hughes in the defense industry. We hope to help in that area," he said. Hughes Aircraft chairman Allen E. Puckett also said that GM's added muscle and its cooperative deals with Japanese companies "certainly won't hurt" Hughes's efforts to further penetrate the Japanese market.

Satellite leader. Hughes Aircraft is a leading technology heavyweight in the defense electronics business and is the world leader in the satellite field; it has installed most of the tactical air defense systems for the U.S. and the North Atlantic Treaty Organization and is the Department of Defense's No. 1 supplier of command and control gear.

Its financial results reflect Hughes's growth in the defense boom of the past five years. Sales more than doubled from $2.2 billion in 1979 to last year's $5.8 billion. The private company has never reported its net income, but analysts estimate it ranged between $100 million and $250 million, which is low because of recent production troubles. Hughes's order backlog stood at nearly $12 billion at the end of 1984.

But Hughes's honeymoon with the Pentagon ended abruptly last year. The services found defects in Hughes-made missiles, which forced a suspension in production and progress payments. Moreover, Hughes had to bear the expense of revamping its production to the satisfaction of the services.

Another problem facing GM is Hughes's overstaffing at most levels. Employing more engineers than its competitors is a hallmark of Hughes's programs. Although on cost-plus government programs this might be acceptable, it is doubtful that such featherbedding will be permitted to continue forever. GM's Smith allows that "no one's job is secure, not even my own." Still, he said, Hughes management would continue, with no major changes foreseen right now.

Analysts expect a profit-improvement program to be forthcoming, with better manufacturing a high priority. "I don't know of any company that can't improve its profitability," Smith said.

–Robert J. Kozma and Larry Waller

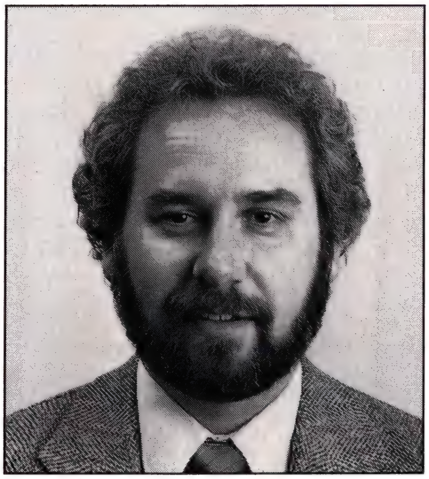
PERSONAL COMPUTERS

APPLE TO CONCENTRATE ON ITS CORE BUSINESSES

Cupertino, Calif.

As the dust settled after last month's power struggle at Apple Computer Inc., an obvious winner emerged: Delbert Yocam, formerly leader of the firm's Apple II division.

Reorganization of the company's operations around traditional marketing and manufacturing lines, announced on May 31, resulted in Yocam's appointment by president John Sculley as executive vice president in charge of product development and manufacturing. In his new position, Yocam is already talking about new strategies—most notably how to position Apple against IBM Corp. in a key segment of the personal computer business: the Fortune 500 companies. (For a story on how Apple's Japanese subsidiary is doing, see p. 34.)



Strategist. New executive vice president Delbert Yocam hopes to polish Apple's image in personal computer markets.

Concentrate on strengths. Yocam insists that Apple will not abandon the corporate marketplace, but acknowledges that "we are going to concentrate on our strengths—in education and small and medium businesses." Where Apple recently sought strategic alliances with major corporations such as General Electric Co. and AT&T Co., sparking acquisition rumors, Yocam says, "If the opportunities present themselves, of course we will go after large accounts. But you won't see us focus so much on specific ones [such as GE]. It takes too much of our resources." The lack of both a hard disk for the Macintosh 16-/32-bit machine and a file server for the Macintosh network, say industry watchers, has severely limited Apple's ability to compete in large-company markets.

Yocam says he "will not rule out the possibility of more layoffs" at the company. Some 1,500 temporary personnel have already been given pink slips; 100 permanent workers were cut from the payroll of Apple's manufacturing facility in Carrollton, Texas, last month when the company announced it would stop manufacturing its Macintosh XL (*née* Lisa), which shared the facility with Apple II products. Currently, the company employs approximately 5,600 workers.

Some observers believe the Carrollton plant may be closed altogether and manufacturing of the Apple II moved to the highly automated Fremont, Calif., Macintosh factory, which has been rumored to be operating at half capacity. Yocam would not confirm the allegation. "We already have a great deal of capacity in our six manufacturing locations, and are analyzing right now if all of it is required," he commented.

"Apple is suffering a bad case of inventory glut just like everyone else," says one analyst, who asserts that making too many computers was the start of Apple's problems. "The Fremont Macintosh plant was 'running' the company—it would have been more realistic to target less capacity. Let's face it, 1985 is not a good year to reach for the moon in the personal computer market."

New job for Jobs. The most publicized event of the reorganization, however, centered not on layoffs or plant closings, but on the person of Steven P. Jobs, Apple's cofounder and chairman, who until May 31 was leader of the Macintosh division within Apple. In what one person called a "bloodless palace revolt," Sculley successfully convinced Apple's board of directors to move the company out of a product-lines organization—effectively removing Jobs from his position. Instead, Jobs will now be the company's "product visionary and innovator," and will report to no one within the company. As chairman, Jobs owns 15% of Apple's stock. He is the largest shareholder.

"It was a difficult position," says Yocam. "Remember, Steve hired John as president and CEO. John was reporting to Steve as chairman, and Steve was reporting to John as head of the Mac division. Now John is taking very much a leadership role." Yocam says Apple is seeking a "technology leader" for Sculley's corporate staff to take up the slack left by Jobs' change in duties.

Many analysts wonder if Apple can survive the shakeup. But most think it was a good decision. "Long term, it was the right thing to do," admits Michael Murphy, editor of the "California Technology Stock Letter" and a continuing champion of the company despite the fact he sold its stock out of his model portfolio. "I still believe they'll be big in three years."

–Denise Caruso

INTEGRATED CIRCUITS

TUNNELING NITRIDE GATE SUITS FAST VLSI CHIPS

Atsugi, Japan

Low resistivity is essential for MOS FET gates in very large-scale integrated circuits: the gates extend out to serve as interconnections, whose resistance-capacitance time delays must be kept low for high-speed circuits.

Were they as reliable as those fabricated in polysilicon, low-resistivity refractory metal gates would be the answer to a designer's prayer. But reliable they are not. So multiple-layer gates must answer that prayer, says Takashi Ito, section manager of the Second Integrated Circuit Process Laboratory at Fujitsu Laboratories Ltd.

Ito's group has found a way to fabricate reliable, low-resistivity gates by using a "club-sandwich" structure: layers of polysilicon—silicon nitride so thin that electrons can tunnel through it—followed by molybdenum, and then a second silicon nitride layer (see drawing). Because Fujitsu Labs is a wholly owned subsidiary of Fujitsu Ltd., the gates presumably will turn up first in Fujitsu memory devices.

The gate building starts with the deposition of a polysilicon film 200 nm thick on the thin gate oxide. It is implanted with As+ (positive arsenic) ions and then coated with nitride in a reactor at 600°C to give a tunneling nitride film about 2 nm thick. The growth is self-limiting and produces a film that is uniform and dense despite its thinness.

This step is followed by the deposition of a molybdenum film 200 nm thick by magnetron sputtering and a silicon nitride film 100 nm thick. The top silicon nitride layer acts as a mask for ion-beam implantation of the source and drain regions after the dry etch that defines the gate.

After annealing at temperatures above 900°C, the films have a resistivity of 0.5 Ω per square, about 100 times lower than that of polysilicon gates. Moreover, there is no degradation in completed device characteristics after exposure to temperatures above 1,100°C, which confirms that the structure can withstand subsequent wafer-fabrication processing. The tunneling-silicon-nitride layer effectively prevents both silicidation of the underlying polysilicon gate and diffusion of impurities from the molybdenum into the polysilicon.

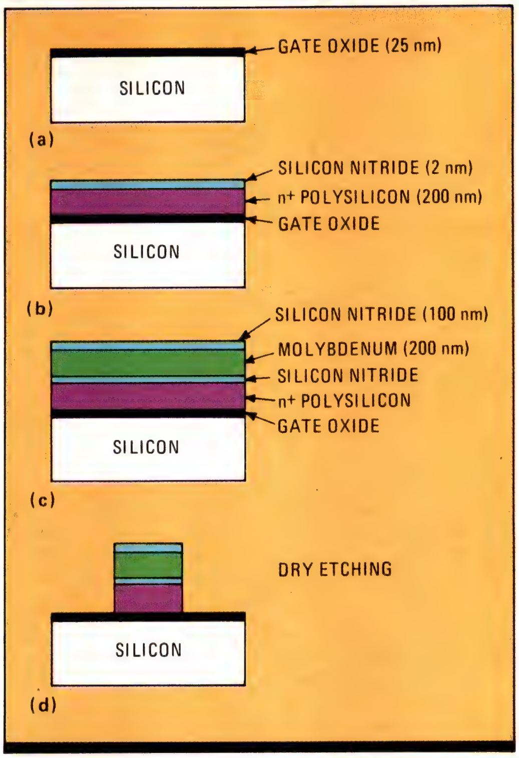
Tunneling FETs. Researchers call the devices fabricated with the new gate structure MTP (for metal/tunneling-nitride/polysilicon gate) FETs. Experimental MTP FETs fabricated with a gate oxide thickness of 25 nm, an effective channel length of 1.3 μm, and an effective channel width of 10 μm have characteristics identical with those of conventional FETs with the same dimensions. No effect has been seen that could be attributed to the tunneling-nitride layer between the molybdenum and polysilicon layers, the company claims.

A 29-stage ring oscillator with enhancement drivers and depletion loads was fabricated with the same design rules. When operated from a 2.5-V power supply, it has a propagation delay of 260 ps per stage and dissipates 500 μW per stage.

Because this process has not been available previously, some VLSI circuits—especially memory chips—have been manufactured with molybdenum or tungsten silicide gates. Resistance is about one order of magnitude lower than that of polysilicon gates but an order of magnitude higher than the MTP gate or metal gates. Silicide gates have the further disadvantage of impurity ions or metallic ions that diffuse into the gate oxide, causing degradation in characteristics, especially dielectric strength.

As for metal gates, they have the drawback in that the threshold voltage tends to be high and unstable. Attempts have been made sporadically for more than a decade to use self-aligned refractory metal gates, but they have not caught on. The new MTP gates provide the advantages of metal gates but skirt their problems.

Even the greater complexity of the MTP gates is probably illusory because their fabrication processes are straightforward. Attempts to use metal gates, however, will almost certainly involve difficult process conditions. *–Charles L. Cohen*



Tunneling gate. The sandwich structure of an MTP gate has at its center a layer of silicon nitride so thin that electrons can tunnel through it. It lies between a layer of molybdenum and one of polysilicon.

DATA BASES

FRENCH PHONE DIRECTORY EXPERIMENT EXTENDED

Paris

Beginning as soon as the end of next year, when a French telephone subscriber wants to look up a number, he will be able to simply turn on his own miniature terminal and dial in to the world's largest distributed data bank.

The Direction Générale des Télécommunications (DGT) is set to give the green light to extend nationwide the electronic telephone directory experiments. Up to now, the trials have taken place in isolated regions of France. If all goes according to plan, by the end of 1986, the DGT will be distributing Minitel terminals to subscribers in place of standard telephone books.

Providing access to telephone directory information by way of home terminals may seem a simple enough task, but in perspective, the French project is impressive (see "French system faces access, usability pains," p. 20). When the project hits full stride by the end of the decade, it will provide 24-hour access to 25 billion figures and letters in the directory and advertising information for some 23 million subscribers.

What's more, the data base will be updated daily to the tune of 50,000 average changes, and it is based on an interface so simple that it can be used by anyone who can read and write. The system can handle up to 6,000 simultaneous requests for information.

The directory's architecture will consist of a single national data-base center in the Breton city of Rennes, to which will be added regional data base centers in Bordeaux (southwest), Lille (north), Marseille (south), Rennes (west), and Paris (capital and east).

The centers, designed by Cap Gemini Sogeti SA, France's largest data-processing, engineering, and consulting firm, will be based on Bull Group's Mini 6 computers with CP8 front-ends. A Philips subsidiary, Télécommunications Radioélectriques et Téléphoniques, will supply the CP8s. Copernique SA will provide Diram 32 data-base access accelerators, which add cache memory and associative search capability.

Access to those data-base centers will be controlled by routing centers designed by Société d'Etudes des Systèmes d'Automation, which are based on Mini 6 computers with DPS 25 front-ends supplied by Bull. A concentrator and videotex access system, through

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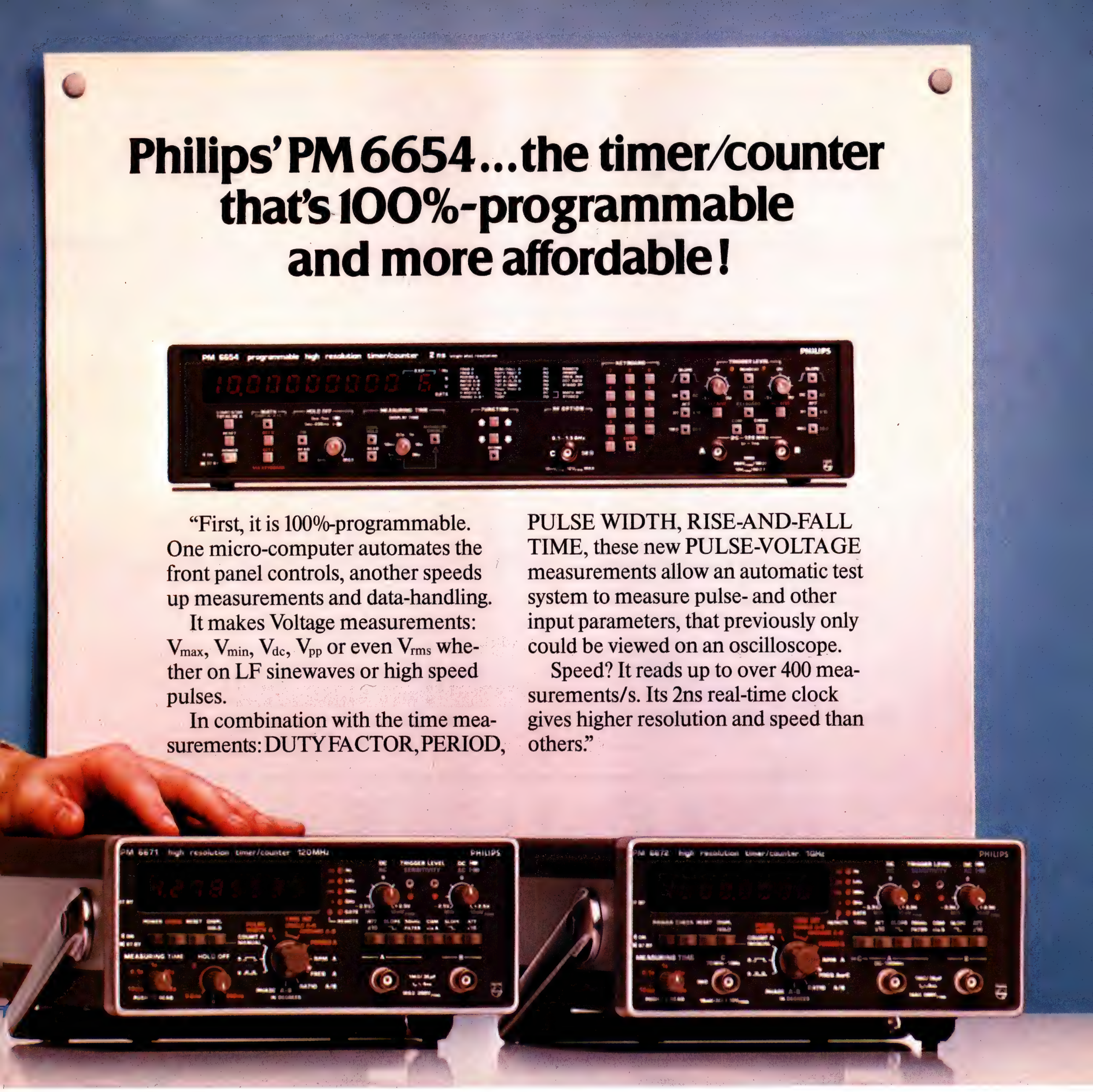
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Circle 67 on reader service card

FRENCH SYSTEM FACES ACCESS, USABILITY PAINS

The design of a system such as the French electronic directory presents two basic problems. The first and most obvious is the data-processing and networking challenge of giving access to an enormous data base to millions of subscribers throughout the country. But perhaps just as difficult, and somewhat more subtle, is the notion of creating an interface that can be easily managed by anyone who can use a telephone.

Subscribers will obtain access to the electronic directory by dialing 11, a signal to their local exchange to connect them with a videotex access point and concentrator that displays a request-for-information page on the subscriber's Minitel terminal. When the subscriber has indicated the information he requires (for example, telephone number of a specific subscriber or list of subscribers under a heading in the commercial directory), the access point sends the request to the nearest routing center.

If the information requested is for the subscriber's own geographic area (as are 80% of requests), the request will be routed to his regional data center. If it lies outside that region, it will be sent by way of Transpac, the French national packet-switching network, to the national data center in Rennes. If any of the regional centers are out of operation, requests are automatically sent to the national center.

Besides directing requests to the correct data center, the routing center also performs a vital user-interface task: it corrects or completes any incorrect or incomplete requests for information. If the name of a subscriber or that of a location is spelled incorrectly, the routing center will suggest the alternative that corresponds most closely to the request.

For example, if the routing center receives the request for the telephone number of J.P. Dupon in Marseil, for example, it will complete the request to one for the number of J.P. Dupont in Marseilles. Should a subscriber ask for the listing under the commercial heading of "masseur" in a given town, the center will correct the requested entry to *kinésithérapeute,* the French word for physiotherapist and the correct directory entry. –**R.T.G.**

which subscriber inquiries are switched before reaching a routing center, was designed by CIT-Alcatel. Terminals are being produced by Telic Alcatel, Matra SA, and Philips subsidiary RTC La Radiotechnique Compélec.

French officials are quick to admit that their motive in taking the electronic directory to the level of a national service is broader than simply trying to improve their directory assistance capability. At home, an installed base of several million Minitel terminals will create substantial network traffic, with subscribers using the more than 1,200 videotex services now available in France.

On the international front, officials expect the French companies involved in the project to be able to sell their expertise in inexpensive terminal production, videotex servers, network management and software engineering by using the national electronic telephone directory as a showcase. *–Robert T. Gallagher*

TEST AND MEASUREMENT

SMD FIXTURES STAR AT ATE SHOW

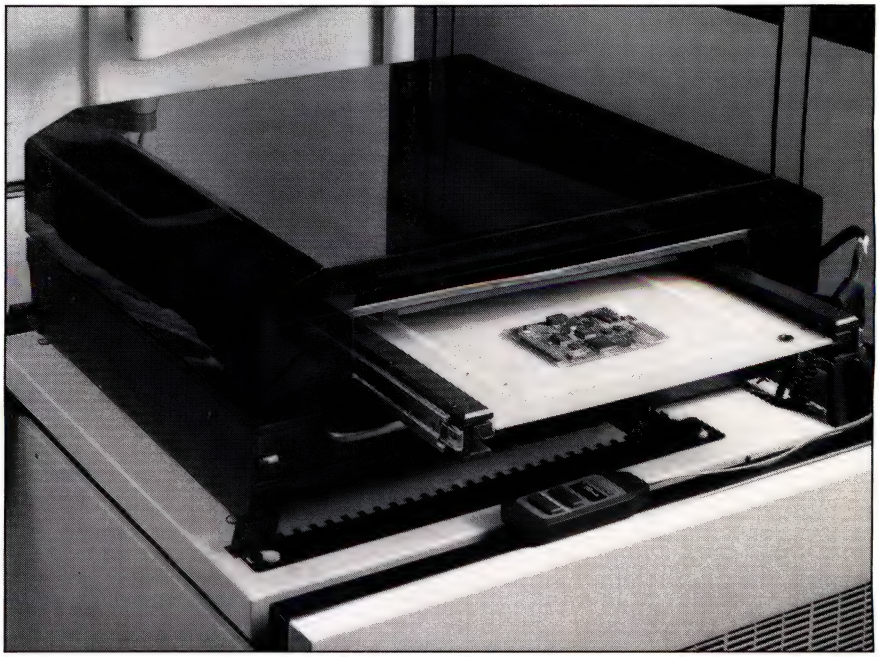
Boston

Surface-mountable devices figure to be the hottest topic among the more than 5,000 attendees expected at the ATE East automatic-test-equipment show this week. Board makers are pushing hard for better ways to test SMDs in order to tap the technology's potential cost saving. And test-equipment vendors, sensing that it is time to get serious about surface-mount technology, are responding with new gear.

The most serious issue they confront is fixturing. Designing fixtures for two-sided boards can be a nightmare; problems include registration repeatability, heat dissipation, and long lead wires that degrade signals. The fixtures are also very expensive and often cannot meet the demands of even medium-scale production.

Cutting costs. At ATE East, Teradyne Inc. will announce a new fixture it says will bring the cost of fixtures down dramatically. Called the L200/SMT and designed for the Boston firm's L200 testers, the new product costs between $10,000 and $12,000 but uses replaceable fixturing plates and nests (the carriers that hold the board under test).

Because the plates and nests need only be drilled and wired, explains Paul DiPerna, fixturing manager in Teradyne's Manufacturing Systems Division, there is no engineering involved in changing them and a substantial cost saving is realized. He estimates the cost of changing plates at about $2,000 to $3,000.



Test fixture. Teradyne intends to cut testing costs of SMDs by means of a test fixture having replaceable probe plates. They need only drilling and wiring to adapt them to specific boards.

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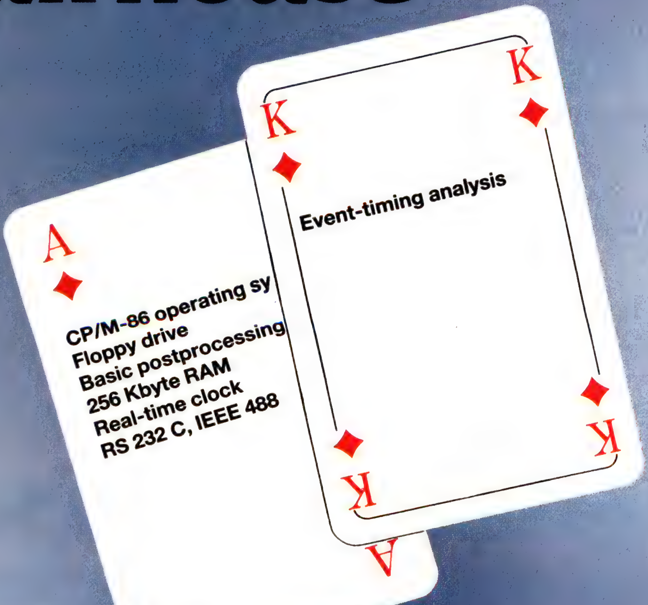

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Circle 68 on reader service card

The fixture can test boards measuring up to 12 by 14 in. with pad spacings down to 50 mils, and uses up to 2,000 probes. Registration repeatability between the upper and lower probe plates is ±1 mil. The tight tolerances are the result of using linear roller bearings and precision shafting, says DiPerna.

To keep lead wires to a maximum length of 18 in., Teradyne uses transfer-post technology, in which test data travels from pins on the probe plates to transfer pins at the outer edges of each plate and then back to connections in the test system. The company is also considering the use of single-socket probes that allow the use of plungers with diameters up to 20 mils, larger than have customarily been used. Presumably, these would be more durable than thinner plungers.

Air-actuated. During testing, the fixture's upper and lower probe plates are pressed against the nest, which rides between them in an air-actuated horizontal frame. To avoid heat buildup, actuation is by compressed air rather than by a vacuum. The fixture can also be used to test conventional through-hole boards.

Teradyne, working with a fixture house, began developing the new product in January 1984, but it was not until last summer that the decision was made to build the fixture. For the past two years, says DiPerna, "Everyone has been saying 'next project, next project [will be surface mount],' but it didn't materialize. Now everyone is really beginning to go forward with surface mount."

Teradyne, of course, is not the sole test-gear maker getting into the market with equipment for SMD boards. Zehntel Production Services in Walnut Creek, Calif., designed an SMD fixture more than three years ago.

The unit, called Access 2, was designed as a discrete fixture, but Zehntel has since developed a universal unit for internal use. Bob Ratcliff, program services manager, says that in the future Zehntel will probably take the universal approach.

At Factron/Latham, a testing division of Schlumberger Ltd., Dick Albright, director of functional products, says the cost of fixturing is causing board makers to consider functional testing rather than pin-by-pin checking. The cost of fixtures is being driven up by demands for smaller and smaller tolerances and, "In some of the things I've seen, people are talking about 0.020- to 0.025-in. centers," says Albright.

So at ATE East, Factron/Latham will unveil a new combination tester with both functional and in-circuit features. "People are worried about the future and want to cover both bets," says Albright. *–Craig D. Rose*

COMPUTERS

STANFORD REVAMPS LAB, SEEKS TOP RESEARCHERS

Palo Alto

Stanford University is reorganizing its Computer Systems Laboratory, bringing in a new administrator and focusing on cross-breeding computer science with engineering. As part of the restructuring, the school is scouring the world for top-flight computer science specialists and recruits to perform basic research on systems from architecture to silicon and software.

Formerly operated as an adjunct of the school's electrical engineering department, the lab will have far greater scope, and for the first time a direct link to the computer science department, which last fall was transferred to engineering's aegis from the Department of Humanities and Science.

The move was accomplished by James Gibbons, the new dean of engineering who in January brought in artificial-intelligence pioneer Nils Nilsson from SRI International to head the department. Nilsson and EE dean Robert White then pooled resources to come up with room in the budget for substantial staff increases. The university may add as many as 10 faculty members.

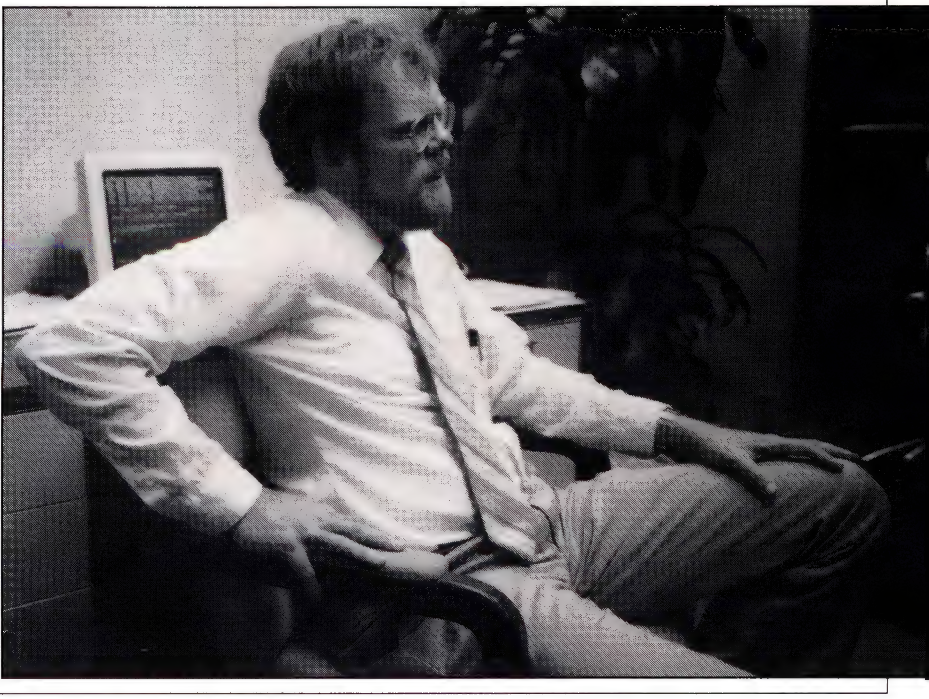
Returning to Stanford to head the lab will be John Hennessey, who for the past year has been on leave as chief scientist of Mips Computer Systems Inc., of nearby Mountain View. Hennessey developed the reduced-instruction-set-computer (RISC) very large-scale integrated circuit that is the basis of the Mips computer while a professor in Stanford's electrical engineering department and head of the computer lab.

The separation of electrical engineering from computer science had hindered the development of the computer systems lab, according to White. "It was difficult for us to hire outstanding faculty because the computer scientists naturally wanted to be in the computer science department," he says. "Now we're on the same side instead of competing for faculty." Adds Hennessey: "This is going to unify a lot of research efforts into architectures, hardware, compilers, operating systems, and applications. You really can't separate them."

Nilsson, a strong supporter of the systems lab, is also developing an undergraduate computer science major with an emphasis on engineering. "Computer science is applied math," he explains. "In order to build something, you need an interface with electrons."

The undergraduate major is still in the formative stage, chugging through academic procedures. "We have to let the process mature," Nilsson said. The major may be offered by the 1986-87

Back in the classroom. Returning to head Stanford's Computer Systems Laboratory will be John Hennessey, former professor in Stanford's electrical engineering department who has been on leave for the past year as chief scientist of Mips Computer Systems Inc.



academic year, and will lead to a BS in computer science. A joint EE/computer science degree is also a possibility.

According to Nilsson, Stanford had resisted giving an undergraduate computer science major in an attempt to leverage the influence of the graduate department. It changed its mind upon noting that more than half its graduate students had been undergraduate computer science majors elsewhere.

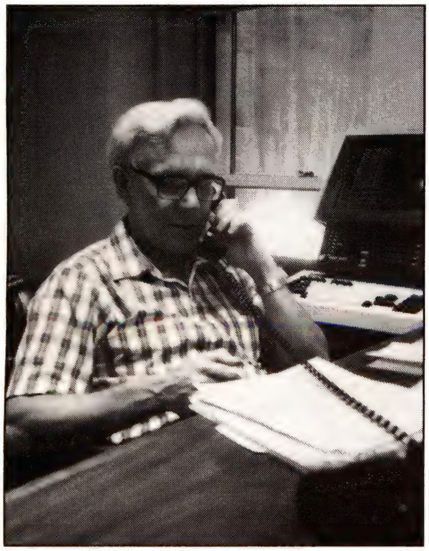
Concentrating resources. The systems center may be housed in Stanford's new Center for Integrated Systems, a $15 million joint industry-government-university research center that was dedicated last month. The EE department currently is scattered throughout nine buildings in Stanford's self-described "industrial slum."

White's goal is to get all of the people in the computer systems lab into the same building. "CIS is where the systems and people work together," White says. "Now we have a chain all the way from computer architecture to silicon to testing."

Stanford will provide about $400,000 for equipment. "It doesn't sound like a lot, but we get a lot for our dollar," White points out, referring to the bargain prices and outright gifts from private industry that the university is able to obtain.

At the University of California at Berkeley and Massachusetts Institute of Technology, two other leading computer science centers, the discipline is part of the EE department. Stanford's approach puts electrical engineering and computer science on the same footing.

Both White and Nilsson stressed that Gibbons was the chief architect of the plan. *–Clifford Barney*



New developments. Artificial-intelligence pioneer Nils Nilsson, who heads Stanford's computer science department, wants to develop an undergraduate computer science major with an emphasis on engineering.

NEWS BRIEFS

Mostek president resigns after reorganization by UTC

With a special task force running Mostek Corp., the president of the troubled MOS-circuit maker has stepped down after a major reorganization, millions of dollars in losses, and thousands of layoffs earlier this year. Harold L. Ergott Jr., president of the United Technologies Corp. subsidiary since early 1982, has returned to the parent company's headquarters in Hartford, Conn., for a new assignment, according to a Mostek spokesman. No successor has been named yet for the Carrollton, Texas, company, where nearly a dozen executives—operating as a special task force—are attempting to run the firm and trim costs under the direction of United Technologies senior vice president Richard Gamble [*ElectronicsWeek,* May 20, 1985, p. 20].

TI, Voice Control Systems settle suit out of court

Even as a grand jury continues its criminal investigation into allegations of trade-secret thefts, Texas Instruments Inc. says it has settled out of court a civil suit it filed two weeks ago against a small voice-technology firm, also based in Dallas. The agreement states that TI retains control over its trade secrets while Voice Control Systems Inc. will be allowed to market its own speaker-independent voice-recognition technology. The two firms became entangled in a series of legal filings late last month after a controversial search of Voice Control Systems by Dallas County investigators [*ElectronicsWeek,* May 27, 1985, p. 13]. TI notified the district attorney in May that informants had reported confidential documents were taken by former TI employees involved in research on speech-recognition algorithms. Officials at Voice Control Systems deny that any of its workers are involved.

Sinclair's pirating suit against Brazilian maker tossed out

In an important precedent that should discourage similar actions against Brazilian firms, the first lawsuit brought by a foreign computer manufacturer against a Brazilian company alleging that a product had been pirated has been thrown out of court. The suit was filed in 1983 by Sinclair Research Ltd. of the UK against São Paulo-based Microdigital Eletronica Ltda., accusing the Brazilian firm of copying the circuitry, keyboard, and operating system of the ZX81 personal computer to produce its own TK82. Not only did the judge throw out the allegations, but he called for punishment of the two computer experts who made the report on which the accusation was based.

Tandon wins a round in patent-infringement suit against Japanese

Tandon Corp. has won an initial round in its effort to stem the flow of imported Japanese floppy-disk drives into the U.S. A judge at the International Trade Commission recommended that the Chatsworth, Calif., firm be given temporary relief in its patent-infringement case against Japanese manufacturers Sony Corp., Mitsubishi Electric Corp., and Teac Corp. Tandon filed its complaint in December, claiming that the three used its patented design for double-sided disk drives to cut production costs and flood the U.S. with units that undercut prices by more than 30%.

Berlin firm to build magnetic-head plant in Ukraine

Soviet authorities have awarded Berlin-Consult, an engineering and contracting firm in West Berlin, a $10 million contract to put up a plant in the Ukraine to produce magnetic heads for audio tape recorders. Supplying the production know-how will be Ferrotronic GmbH, also of West Berlin. The plant, to be ready by 1987, will be built in Zaporozhye to turn out about 900,000 heads a year. For Berlin-Consult, which plans and builds factories primarily in Eastern Bloc countries, the new plant is the second for magnetic heads it has erected in the Ukraine. The first, in Kiev, was built eight years ago.

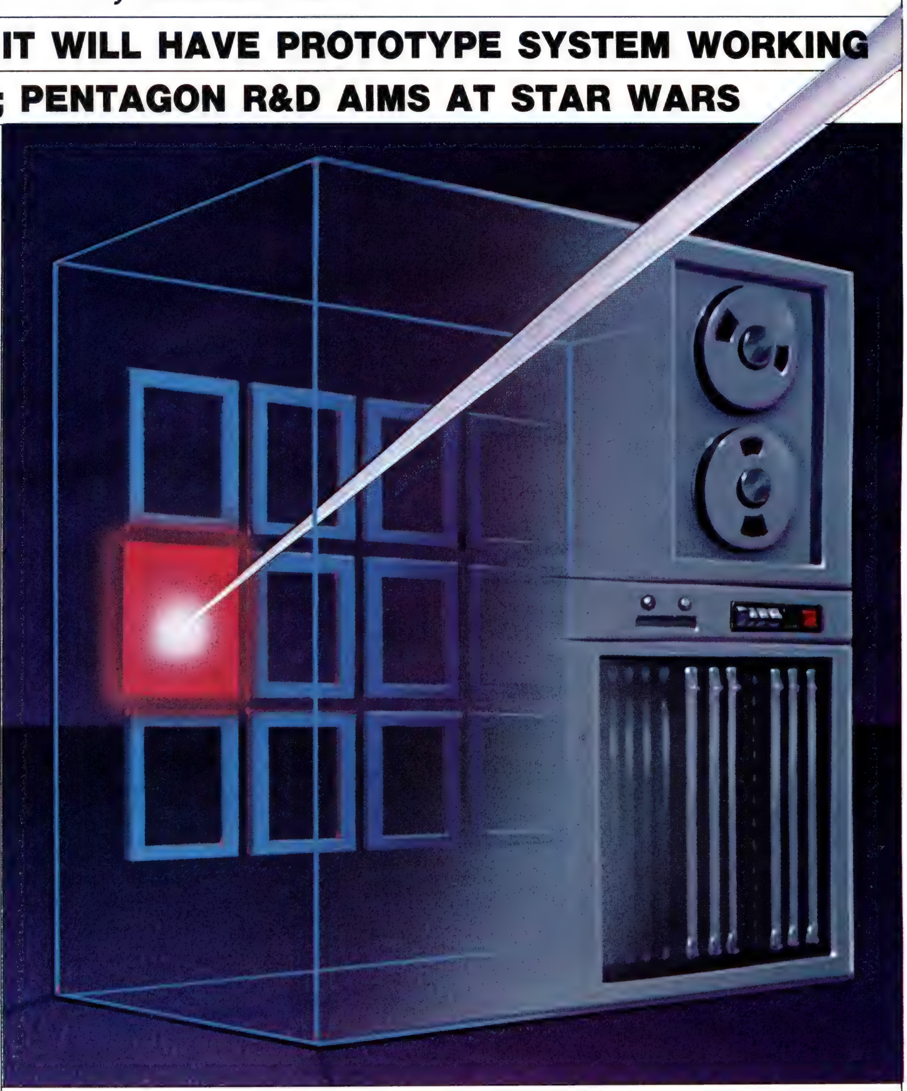
Briefcase-size computers pegged as most-promising portables

Portable computers should be a market worth nearly $2.8 billion by 1989, according to a study by Frost & Sullivan Inc., a New York market-research house. The study singles out briefcase-size computers as the most promising sector. Models with full-page displays are expected to reach the market next year. Growth rates of 14% a year will carry the market to $818 million by 1989, the study projects. The growth in units will be even higher: 24% a year to reach a level of 770,000 by the end of the decade.

OPTICAL COMPUTING IS BEGINNING TO TAKE ON THE GLOW OF REALITY

by Alexander Wolfe

BELL LABS BETS BIG IT WILL HAVE PROTOTYPE SYSTEM WORKING IN FIVE YEARS; PENTAGON R&D AIMS AT STAR WARS



New York

The concept of building a computer that calculates with light rather than with electrons began kicking around nearly a decade ago. Since then, interest in optical computing has peaked and ebbed several times. Often this technology was oversold or the subject of exaggerated claims.

Now, however, optical computing is turning quickly into a serious research effort at several laboratories. For the first time, a leading company is betting big that this could be the next wave of computer technology. AT&T Bell Laboratories is forging ahead with the first concerted effort to build a programmable digital computer using optical components. At the same time, two major research programs funded by the Pentagon are about to get under way.

The optical computing effort at American Telephone & Telegraph Co. is an outgrowth of the fiber-optics driven technology boom in telecommunications. "We've essentially bet our company that lightwave is the future," says Robert W. Lucky, director of communications research at Bell Labs in Holmdel, N.J.

Bell Labs has a highly ambitious program. "We now know an optical computer can be built, and we know it can be practical in terms of having a distinct advantage over large-scale integration," declares Alan Huang, head of optical computing at the lab. He is convinced that over the next couple of years the lab can design and construct a prototype programmable optical digital computer, using optically sensitive semiconductor-devices built from gallium arsenide.

By concentrating its efforts on this nascent technology, Bell Labs is taking a major risk. Other players are concentrating on old-line acousto- and electro-optical technologies or pursuing narrow-focus efforts. But optical-GaAs has high potential, and Bell Labs could leapfrog everyone if its researchers can build a optical computer with it that works.

While many researchers are skeptical of Bell Lab's near-term prospects, they do believe chances are good it will ultimately succeed. And they agree with David Casasent, director of Carnegie-Mellon University's optics lab, that optical computing "is a very, very hot area right now." One notable holdout is IBM Corp., which has no concentrated effort underway. "We're rather negative on optical computing," says a spokesman.

The development effort at Bell Labs picked up speed last fall when researchers demonstrated a working optical logic gate. "Now the push is to get large arrays of gates working," Huang says. He foresees these milestones:

- "Within the next several months we'll have small arrays [perhaps 10 by 10] of these devices."
- "In the next year we should have a primitive demonstration of an optical state machine."
- "We could get a lab prototype of a real number-cruncher, a really full-fledged machine, in five years."

The project's key optical semiconductors are fabricated as 100-decker sandwiches with alternating layers of GaAs and gallium aluminum arsenide [*Electronics*, June 28, 1984, p. 102]. Each layer is only tens of angstroms thick. Known as bistable devices (and more exactly as multiple quantum well—MQW—or superlattices, depending on the precise thickness of the layers), they are optical analogs of the electronic logic gate.

Pioneered by Bell Labs, Heriot-Watt University in Edinburgh, Scotland, and Massachusetts Institute of Technology's Lincoln Laboratory, the physics of bistable devices are complex and still not fully understood. Conceptually, however, they can be thought of as adders that use light. One laser beam incident on a device would yield an intensity of "1" at the output, and dual beams a "2". With the addition of a thresholding mechanism, OR and AND logic functions are easily set up.

Best and brightest. Though the emerging bistable devices may offer the best and brightest in semiconductors, optical computing is not being sold as a device-driven technology. Rather, it is seen as ultimately offering orders-of-magnitude gains in processing speed, owing to its architecture. "The advantage of optics is in parallelism," says Bell Labs bistable-device scientist David A.B. Miller.

Optical computer components need no physical hookups—light provides the "wiring." This yields a twofold advantage. First is the ability to construct large parallel-processing units or arrays, which speeds processing through the simultaneous handling of huge chunks of information.

In standard computers, parallel-circuit construction reaches its limit at the point where stringing more wires and printed-circuit-board connections between components becomes insurmountable. The simultaneous computing advantage thus has limited application in electronics. Additionally, propagation delays and clock-skew problems, which limit operating speed, worsen as the interconnection density increases. So most machines end up doing their processing serially (and relatively slowly).

Optics' real throughput knockout, however, comes from the potential clock rates of optical computers. Currently, Bell's Huang foresees a 100-MHz prototype machine. Today's typical minicomputer, such as Digital Equipment Corp.'s VAX-11/780, runs approximately 1 million instructions per second. The bistable devices themselves today can switch in the picosecond range, and optics reseachers casually toss around femtoseconds as an achievable switching speed. (A femtosecond is 10^{-15} second).

Although device switching speed does not translate directly to processing speed, typical projections for future optics assume an advantage of several orders of magnitude over electronics, which will hit a limit of a few gigahertz. Bistable-based computers

COMMERCIAL OPTICAL COMPUTER IS STILLBORN

According to 33-year-old Peter Guilfoyle, on March 30, 1984—"one day behind schedule and under budget"—the world's first commercial optical digital-computer prototype, a 32-bit model, was completed. At the time, Guilfoyle was president and chairman of the board of Guiltech Research Inc., the Sunnyvale, Calif., firm he founded in May 1981.

Originally, Guiltech gathered together a group of heavy-hitting optics experts. This consortium hired itself out as consultants to the powerhouse prime contractors in the acousto-optics signal-processing field—Hughes Research, Itek Applied Technology Division, and ITT Avionics. "Back in those days, those were they only people working in the field, because they could afford the technology," Guilfoyle says.

Concurrently, the concept for a digital optical computer, based on acousto-optic technology began to take shape. However, this idea was relegated to the back burner in favor of Guiltech's lucrative consulting business. Then, in August 1982, Guilfoyle published the first version of a paper on a systolic acousto-optic binary convolver. Favorable response sparked an effort toward building the system. "We combined the advantages of systolic arrays, the speed of optics, and the accuracy of binary computation in our concept," he says.

"That's what we went to the venture capitalists with. It took a year to get funding." The financing—$850,000 worth—was raised through Venrock Associates in New York and Arthur Rock in San Francisco, and Guiltech set about developing the prototype.

The machine itself was positioned to sell against standard electronic computers. Guilfoyle's benchmark design goal was 1 billion floating-point operations per second. This speed "was the crossover point where you could debate the technical issues [optics versus electronics] one way or the other." Below 1 gigaflops, silicon had the edge. "To go to 2 gigaflops in silicon takes 6,000 chips—it's ludicrous," Guilfoyle says. But at precisely 1 gigaflops, so Guilfoyle thought, the machine would fly.

"My approach was to build it and ship it," he states. Actually, the prototype hardware demonstration unit was a vastly scaled-down central processing unit. A 4-by-4 array, its purpose was to demonstrate the concept's feasibility. The planned next step was to have been a 32-by-32 array, with a performance of 533-megaflops.

Last March, with the prototype up in the lab, Guilfoyle's dream of being first to market with a product began to unravel. His company went back to the bankers for money to proceed to the beta-test stage. Now, however, John Grigsby was at the company's helm. He had been installed at the behest of some of the investors, Guilfoyle says.

Money was plentiful, however. The offering was heavily oversubscribed; seeking $6.5 million, Guiltech raised $10.1 million by Nov. 1. But a classic entrepreneurial struggle was heating up. Says Guilfoyle, "I lost control [of the company] in the second round of financing."

According to Guilfoyle's account, Bill Oakley, an engineer and partner in the firm, proposed scrapping the optical machine entirely and going forward with an electronic design based on very large-scale integration. Initially, in December, the board of directors rejected this plan.

In February, however, Grigsby offered a somewhat similar compromise proposal: the company would pursue VLSI to the tune of $10.1 million, and $1.6 million would go for a back-burner optics effort. The board approved this plan, but also fired Oakley, Guilfoyle says. Two days later, Guilfoyle was put on unpaid leave, and was officially axed in March. Since then, Oakley has been rehired and Guiltech is at work on the VLSI effort.

Grigsby told *ElectronicsWeek* that he could not comment on company product-development plans.

Only one other company, Aerodyne Research, Billerica, Mass., has had a go at commercial computing optics. But after some initial work, "We decided that the better part of valor was to step back and take another look," says John Caulfield, who headed the effort. Caulfield is currently a consultant to the company and the Defense Department. "It's my fond hope that in the next few years we'll have some breakthroughs," he says.

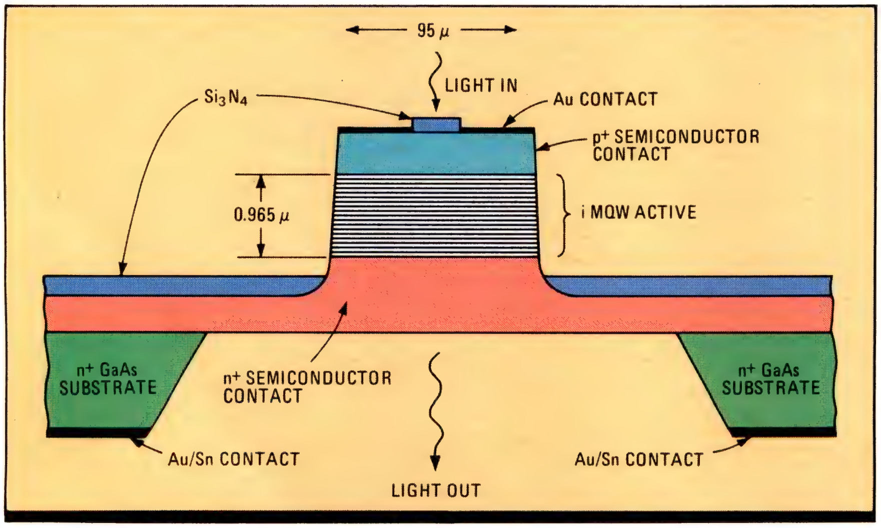
Whither the optical computer prototype? Still at Guiltech, says Guilfoyle. Hoping to continue the quest for the optical computer, he is seeking capital to launch his new venture, a company tentatively called Opticomp. —A.W.

should also easily beat today's specialized acousto-optic processors, which peak out at around 4 GHz.

The most frequent criticism of optical computing has been that real-world designs will butt up against two disabling limitations. The first is that optics are prohibitively power hungry, reportedly a key concern at IBM. Today, bistables require milliwatts to switch. In a large array, this would be equal to a huge amount of watts per bit per second, despite Huang's rejoinder that power per cycle, and not total power, should be considered.

Power politics. Given the evolving state of bistables, however, the debate is on a very slippery slope. If either parameter can be reduced—to produce a slow low-powered device, or a fast, higher-wattage unit—power politics may render the debate moot. But people want speed, and they're willing to spend energy to get it, says Huang, pointing to Cray Research Inc.'s supercomputers as an example.

It's the merging of optic and electronic technologies that's the difficult part, says Peter Guilfoyle, late of Guiltech Research Inc., the Sunnyvale, Calif., company that made the first run at fielding a commercial-market optical computer (see "Commercial optical computer is stillborn," p. 25). The electron-to-photon conversions, which occur at the input and output interfaces of the dissimilar systems, will slow the optics down, causing it to idle while awaiting input. According to Guilfoyle, engineers must "figure out how to make the optics do more computational work internally, in order to get over the I/O bottleneck."



Light logic. Bistable semiconductors, made from thin, alternating layers of GaAs and GaAlAs (shown as i MQW active), will be used to make logic gates in the prototype optical computers.

In Huang's pipelined architecture, 99% of the information will be processed in the optics, he says. The thinking is that ever larger blocks of data can be sucked up at the input end, and the optical machines will repetitively calculate away, without returning for intermediate inputs.

Still, the red flags hoisted by these formidable practical difficulties have led many scientists to consider optical computing a niche technology. This view foresees a hybrid approach. Optical arrays would be developed for image processing and number crunching. These would then be hooked into an electronic system as a coprocessor. Other subsystem niches, such as optical interconnects, would also be developed with an eye toward performance-enhancing integration into standard computers.

Where the bucks are. In fact, the biggest dollar infusion into optical computing is going toward funding niche-technology research. The hope, however, is that synergism between the different niches will help push optical computing over the top. Optics' newest sugar daddy is the DOD, which covets massive computing power for its Strategic Defense Initiative, popularly known as Star Wars.

"My instructions are to aim at a significant breakthrough," says John Caulfield, technical director of the newly formed SDI optical computing consortium. As part of a three-year effort set to begin this July, $9 million will be distributed among eight full consortium members and nine associate members. This funding will emphasize academic and small company research and development efforts.

Much of the consortium's funding will go for optical interconnects. This highly promising area feeds off the rapid advances of fiber optics and lasers. Here, the hope is to make possible large-scale distributed processing by exploiting the no-wires interconnection advantages of optics on a systems level.

Using laser transceivers mounted at the processing end and three-dimensional (holographic) switches to route the laser beam between processors, it should make available vertical as well as planar interconnections that can make possible new distributed-processing architectures.

Hybrid analog/digital optical computers, using analog for difficult computations and digital for simpler ones, are also under study. Acousto-optic systolic-array matrix processors might compose the analog portion, and bistable semiconductors, under study at Lincoln Labs, a consortium member, the digital part. Other full members include the California Institute of Technology, Carnegie-Mellon University, the University of Alabama in Huntsville, Battelle Columbus Laboratories, Stanford University, the University of Dayton Research Institute, and the U.S. Naval Ocean Systems Center.

Consortium associates, also set to share in contract awards, are: Aerodyne Research, Billerica, Mass; BDM Corp., Washington; Harvard University; Houston Research Associates, Saratoga, Calif.; Massachusetts Institute of Technology; Probe Systems Inc., Washington; Science Applications Inc., Bedford, Mass.; the University of California at Irvine; and the University of Southern California.

Prior to his SDI involvement, Caulfield, a respected researcher in acousto-optics, headed one of only two attempts to date to build an acousto-optically based digital computer for the commercial market, at Aerodyne Research. "It is my belief that within a year we can demonstrate within some particular niches that optics can do things electronics could never dream of doing," he says, noting that more government funding should be forthcoming if the consortium's research shows progress. "It's electronics that's holding back optical computing, not optics," Caulfield asserts.

Non-SDI government funding is also gearing up for a planned optical-computing effort. The DOD's Defense Advanced Research Projects Agency (Darpa) will pump $3 million into nonlinear-materials research in hopes of finding compounds usable as holographic switches.

"The real power of optics is in the interconnect arena," says John Neff, Darpa's optoelectronics-program manager. Major contractors Rockwell International Corp. and Honeywell Inc. will develop integrated-optics transceivers. The initial goal is to fabricate a monolithic, medium-scale-integration on-chip laser, detector, multiplexer, and demultiplexer. In electronic/optical hybrids, the chips would allow subsystem interconnects, boosting silicon performance by 20% to 30%.

The Jet Propulsion Laboratory, also a Darpa contractor, is investigating free-space optical interconnects to solve clock-skew problems. The idea is to route laser clock pulses directly to integrated detector chips mounted throughout a computer. Holographic switches would allow nondelayed distribution of the pulse.

Research exploring fixed versus reconfigurable switching, to enable more powerful optical-computer architectures, is also being funded. Noting that Darpa runs the strategic computing effort, the U.S. counterpart to Japan's fifth-generation artificial-intelligence project, Neff says, "I would like to see the Darpa thrust moving toward symbolic computing rather than numeric computing."

Distinctions blur. Optical computing research tends to blur with optical signal processing, an area already highly developed for military applications. This is particularly true in the electronic-warfare field, where pattern recognition and other sophisticated tactical aids are being developed. Many of the applications are on fighter aircraft, hence the need to pack megacomputing power into a miniature space.

Many large military contractors are engaged in independent research efforts on the leading edge of acousto- and electro-optics. A notable effort is currently under way at Hughes Research Laboratories, Malibu, Calif. It has been dubbed the Primo, for programmable real-time incoherent matrix-multiplier optical processor. The unit is a classical electro-optical modulator in which computing is performed as light travels from a source (a light-emitting diode, for example), to a detector. Along the way, the light is modulated by a controlling electrical signal. The strength of the light is proportional to numerical values.

Currently, a primitive 4-by-4 Primo array has been built. Bernard Soffer, who heads the Hughes effort, says his team is shooting for a 32-by-32 array, which will perform 10^{13} multiplications per second, by the end of 1986. The system is similar to the spatial-light-modulator class of devices, which are the most widely used of the special-purpose processors. Primo is unique, however, in that it uses incoherent, or nonlaser, light. This trades off cheaper construction for potential crosstalk problems. Coherent light allows the bistable systems to use individual devices for multiple gate functions, and to cross beams of different wavelength without interference. □

EUROPEANS CONCENTRATE ON DEVICE RESEARCH

Heriot-Watt University, in Edinburgh, Scotland, a leader in optical-switching research, will become the first European participant in the U.S.'s Strategic Defense Initiative, or Star Wars program. The U.S. government will soon award the university a $150,000 contract aimed at bringing the results of its technology research to a commercial stage.

The Heriot-Watt team has been studying optical switching in cryogenically cooled indium antimonide crystal. This material switches from a blocking to a transmissive state when illuminated by an infrared laser. In a recent test, OR and NOR logic gates were placed 0.5 mm apart on a single indium antimonide chip. When scaled up, 1 W could drive a 1-cm^2 100-by-100 array, at 100-ns switching speeds, for a data rate of almost 10^{11} b/s.

Specialized image-processing systems using glass-backed thin films of zinc selenide are also under study. The film is switched between blocking and transmissive states by the heating effect of a laser. In a practical setup, a holographically formed matrix of beams would illuminate a 1-cm^2 zinc selenide slice, biasing it close to the threshold voltage.

This spatial light modulator, as it is called, is at the heart of most image-processing systems. An image falling on the array can control the transmission of laser light to the output; points that are pushed over the threshold are intensity-modulated by the image. Convolution and pattern matching are performed by simultaneously applying two separate images to the SLM. The array's advantage comes from its inherent parallelism, because its switching speed is in the nanosecond range.

At the moment, the Europeans offer no contest to Bell Labs' effort, although the U.K's British Telecommunications Ltd., Plessey Co. plc, and General Electric Co. plc., are all keeping an eye on developments elsewhere. In Japan, work on optocomputing devices is under way at NEC Corp., Tohoku University in Sendai, and the Tokyo Institute of Technology.

–**Kevin Smith**

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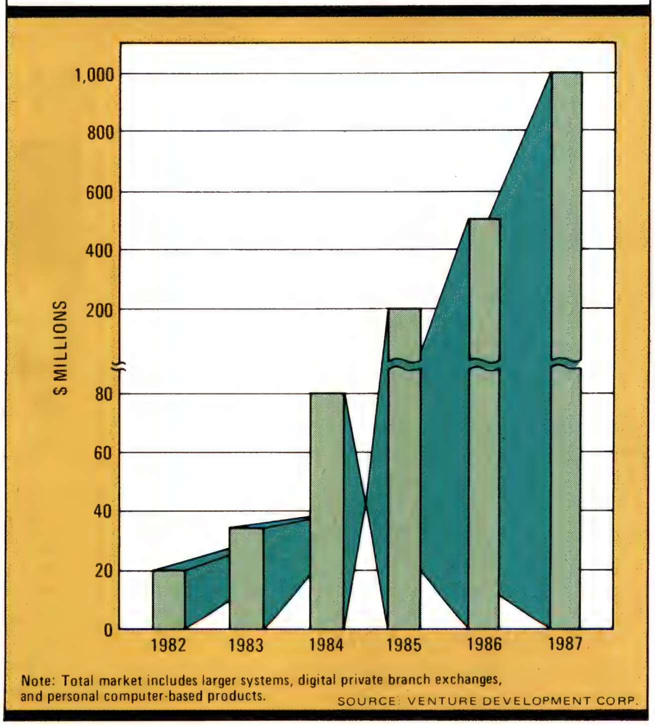
PERSONAL COMPUTERS ARE PUTTING THE SQUEEZE ON DIGITAL PABX VOICE MAIL

by J. Robert Lineback

DESKTOP UNITS ARE BEGINNING TO MAKE INROADS IN THE PROMISING STORE-AND-FORWARD BUSINESS

Almost since the day they arrived on the scene, personal computers have been appropriating growth from existing markets by stealing applications from larger, more expensive machines. Now, microprocessor-based desktop units are treading on the promising new turf of digital private branch exchanges: voice mail.

WORLDWIDE VOICE-MAIL REVENUES BY U.S. VENDORS



Note: Total market includes larger systems, digital private branch exchanges, and personal computer-based products.

SOURCE: VENTURE DEVELOPMENT CORP.

Loaded with digital signal-processing circuits, new speech-compression algorithms, telephony interfaces, and lower-priced hard disks, personal computers are beginning to ring up sales in the embryonic voice store-and-forward business. Worldwide sales of all voice-mail systems by U.S. vendors are expected to reach $200 million this year, which is well beyond double last year's figure of only $80 million, estimates Raymond L. Boggs, consultant for office automation at Venture Development Corp. in Natick, Mass. Most market projections set the 1987 figure at or above the $1 billion mark.

The bulk of revenues in voice store-and-forward systems now comes from large computer-like equipment, with some units capable of serving several thousand users each. But the clear trend is to integrate messaging features into the new emerging voice-data PBXs, Boggs notes, and suggests "that will certainly have implications for those trying to marry personal computers and voice mail.

"People shopping for personal computer-based voice mail will likely be individuals or small and medium-sized businesses, since larger companies will likely have that feature embedded in their PBXs," Boggs continues. "But there are no rules and no guidelines to the game. It's very much like the wild West—everything still in the formative stage of development."

Part of the rule shifting results from a continuous stream of new voice-compression techniques. Most are designed not only to reduce the size of "mailbox" memory requirements but also to improve the perceived quality of digitized voice when bits of it are missing.

Technical Ventures, a two-year-old research and development organization in Loveland, Colo., has chosen to put most of the complexity of a new compression engine into a hybrid speech-processing algorithm. Running the complex voice-processing firmware, a simple hardware architecture from Technical Ventures can reduce standard 64-kb/s speech to as low as 8 kb/s while maintaining acceptable quality.

Designed with telephone transmissions in mind, the proprietary software contains a mixture of adaptive, predictive, and transform-oriented techniques, explains Curtis D. Brown, president of Technical Ventures. At an 8-kb/s compression rate, users can place about six minutes of speech on a conventional 5¼-in. floppy disk.

The algorithm, which also supports 16- and 24-kb/s rates, is divided between the on-chip read-only memory of an Intel Corp. 8051 microcontroller and an NEC Corp. 7720 digital signal processor. The speech-processing algorithm for the 8051/7720 combination is being licensed by Technical Ventures.

"It is intended to be a low-cost, simple hardware system, and therefore we have maximized the complexity of the algorithm to get the most natural-sounding speech at the low bit rates," says Brown. "We have not made any fundamental breakthrough in algorithm technology, but it did take several man-years to research the state of the art and select the right kinds of things for a simple chip-set architecture."

The speech-compression algorithm—which its creators at Technical Ventures haven't named yet—contains linear predictive coding (LPC) for spectral analysis of voice. But at the same time it also contains some sophisticated time-domain features to prevent the "corruption of nonspeech-like sounds over standard phone lines," explains Brown. The blending of time-domain and LPC features prevents voice messages from becoming garbled when more than one speaker is talking, Brown adds.

A prototype for a personal computer add-on board has a standard codec circuit to digitize incoming analog telephony speech to a standard 64-kb/s rate. The data is then repeatedly operated on by the 8-bit microcontroller and DSP chip, which operate both synchronously and asynchronously with each other. As the speech data moves through the processing steps, it is buffered in standard static random-access memory. The compression is performed continuously in real time, Brown adds.

Competitors already marketing voice-mail packages for IBM Corp. Personal Computers and the host of compatible look-alikes face a difficult choice when it comes to deciding how much to spend on compression research, notes Anil Sood, vice president of engineering and advanced development at CMC International Inc. of Bellevue, Wash. For about a year, CMC has been offering its PC Dial/Log products for noncompressed digital voice mail.

"We opted not to go with compression of speech because we did not want quality to be an issue and because prices were expected to drop on hard-disk storage," says Sood. "The hard-disk prices are really coming down, with disks costing $2,500 nine months ago now priced at $1,000." With its speech-processing technique, CMC can store nearly 50 minutes of voice messages on a 10-megabyte hard disk.

CMC uses adaptive delta-slope modulation to digitize speech. "We went with this technique because it offers the best alternative for quality, runs on the least complicated circuitry, and a low sampling rate is often required," explains Sood. "The sampling-rate characteristics benefit the [personal computer] side of the system because it more easily performs other computing applications like word processing simultaneously."

Off the shelf. CMC is selling an IBM PC expansion-slot board with signal-processing circuitry made from off-the-shelf logic components. The standard PC Dial/Log has a retail price of $599. A concurrent PC Dial/Log package, which can perform voice messaging in background to other application software, sells for the same amount.

"The PC-based voice-mail products are now at the stage where data modems were several years ago. The market is not yet that competitive, and I think part of the reason is the hard benefits of voice mail have not quite hit home," says Sood. "The initial reaction to PC-based voice mail is, 'Gee, is this an answering machine?' "

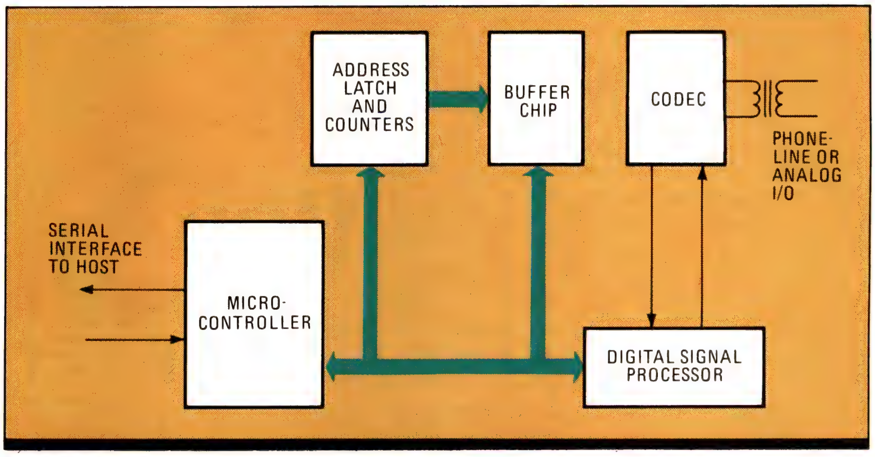
Some personal computer-based voice-mail systems can serve as a computer-based telephone answering machine. Some larger systems can also send and edit messages. Computers can be programmed to automatically dial exchanges at designated times, repeating calls until the voice message is successfully delivered. Some systems allow additional voice notes to be attached to incoming messages before they are forwarded to a new telephone-exchange address.

Taking the speech-compression route to delivering voice-mail products, Natural Microsystems Corp. based in Natick, Mass., has a store-and-forwarding system called Watson for IBM PCs and compatible units. Using a proprietary compression algorithm developed by its researchers and a 32-bit TMS32010 digital signal processor from Texas Instruments Inc., Natural Microsystems is offering storage rates of 32, 24, and 12 kb/s.

"We developed every last bit of the compression algorithm—no pun intended," quips Charles T. Foskett, president of the firm. Besides the voice-mail offering, the compression algorithm is being used in Watson packages for telemarketing, voice-response systems, and dictation.

"One of the reasons for selecting the 32010 was that we knew the 32020 [the next-generation DSP chip, samples of which are now being given out by TI] would be coming along," he remarks. "Eventually, we will take advantage of it, but not right away, because the 32010 is doing pretty well and TI is just now getting the chip price into the range where it is acceptable to us."

With Natural Microsystems' 12-kb/s rate, about five minutes of speech can be stored on a conventional 360-K-byte floppy disk. The higher-quality 32-kb/s rate will place 1.5 min on a floppy disk. The 24-kb/s mode will place about 15 minutes of speech on 2.5 megabytes of a hard disk. On the market since last fall, the Watson voice-messaging product costs $598.



Teamwork. Technical Ventures' speech-processing algorithm is divided between the Intel 8051 microcontroller and the NEC 7720 digital signal processor.

TI's work. TI's Data Systems Group in Austin, Texas, and its MOS processor-chip operation in Houston are both working independently to push the state of the art in speech-compression technology for small computers. On the silicon front, TI has just begun to offer samples of its 32020, which is capable of two to three times faster throughput than the 32010.

The 32020 also has more off-chip memory-addressing capability [*ElectronicsWeek*, Feb. 11, 1985, p. 20]. It is expected to provide about the same amount of compression muscle as TI's current 32010, but once the voice has been processed, it will be able to do more things with the digital speech.

Currently, chip customers are using the 32010 to digitize speech in rates ranging from standard 64 kb/s to as low as 100 b/s. (Standard compression rates, however, are 2.4, 9.6, 16, and 32 kb/s.) TI recently released application design material showing how the 32010 can be used to convert speech to 32 kb/s using adaptive predictive pulse-code modulation (ADPCM).

The company says the technique conforms to the recently proposed 32-kb/s digital-network transmission standards from the International Consultative Committee on Telegraphy and Telephony (CCITT).

On the systems side of the business, TI's Data Systems Group in Austin is working with several unnamed voice-mail systems houses to develop store-and-forward messaging systems for its business computer products, such as the IBM PC AT-compatible Business-Pro [*ElectronicsWeek*, March 25, 1985, p. 16]. For nearly two years, TI has been offering 2.4-kb/s speech-compression rates on its 8088 microprocessor-based personal computer. The 2.4-kb/s rate, like its recently announced 9.6-kb/s rate, is produced by an LPC technique.

Pitch-excited LPC—a technique that relies more heavily on vocal track sounds such as pitch or frequency compared with nonvoiced sounds in speech caused by air movement—often suffers when it is sent over standard phone lines because the frequency of pitch is at or below the low end of telephone response (about 100 Hz).

TI is promoting its ADPCM-encoded 32-kb/s speech for telephony use. A new speech-processing board, based on the 32010, offers all three rates from TI and sells for $995. Application and development software is extra. ☐

JAPANESE QUIT ON IBM SOFTWARE, TURN TO UNIX

by Jonathan Joseph

THE SEARCH FOR A STANDARD OPERATING SYSTEM LEADS TO AT&T AFTER YEARS OF TRYING TO GET THROUGH IBM'S BARRIERS

Tokyo

When Japanese computer-software pioneers plunged into that brave new world more than a decade ago, they took two paths. One band, lead by Hitachi Ltd. and Fujitsu Ltd., cut out after IBM Corp. The other, following NEC Corp.'s lead, struck out on scattered, independent tracks, linked only by their noncompatibility with Big Blue.

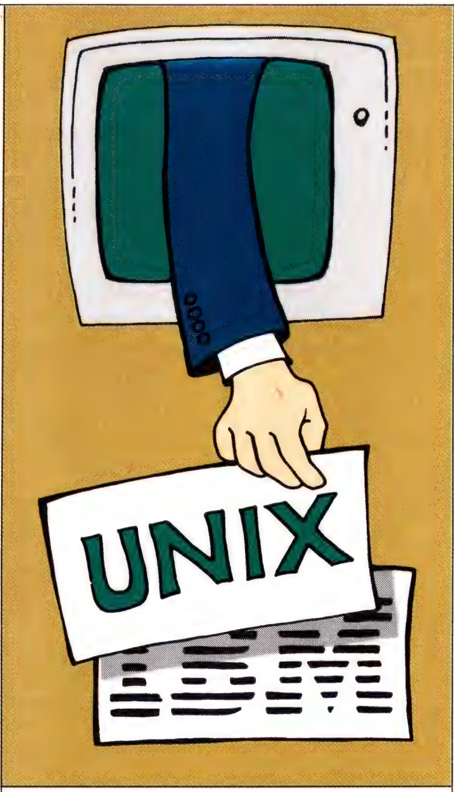
But the two-path approach to software operating systems is changing in Japan. In recent years, the country's computer giants have felt the sting of IBM's efforts to keep its operating system proprietary and have begun searching for a neutral software standard. For the first time in a decade, the major Japanese computer makers are looking at a third road: AT&T Bell Laboratories' Unix operating system. And most of them like what they see.

"We've got to find another standard," says Susumu Tomioka, manager of the Fujitsu software division that is developing Unix for the leading Japanese computer firm. "We're moving away from the IBM system, and Unix is the strongest third candidate for that."

"Unix presents a significant standard for the Japanese," says Chris Christiansen, senior analyst with the Boston market research firm, the Yankee Group. "It frees them to do what they know best—be hardware vendors."

Following the market. The Japanese computer vendors are following the American market closely. Analysts in Japan point out that a movement toward Unix-based operating systems is inevitable considering their increased popularity in the U.S. market. Indeed, the Japanese search for a software standard has an importance that extends beyond the local market. Despite great efforts, none of the Japanese personal computer makers yet holds even 1% of the U.S. market.

Although many American analysts ascribe the problem to marketing and distribution, many Japanese manufacturers think their real weakness is in software. By finding a neutral operating-system standard, the Japanese may better penetrate international computer markets in ways that so far they have failed to do.



In its long-term strategy, Japanese industry has until recently all but ignored the Unix workhorse, an operating system developed by Bell Labs almost two decades ago. But in the past year, the rising tide inching up to Unix has become a veritable flood.

Since last spring, most of the major computer firms in Japan have come out with new machines able to run on a Unix-based operating system and application software. Last May, NEC added a Unix operating system to its repertoire for the 9800-series personal computer, the 16-bit office-automation tool that is taking the Japanese market by storm. In 1982, Toshiba Corp. worked with AT&T to develop the first Japanese-language Unix-based operating system and last February came out with the UX-300 FII Tosbac minicomputer, which retails for $16,000. In just three months, Toshiba has sold more than 2,000 units.

And just last month, Fujitsu began selling both a Unix-based M-series mainframe, the best-selling machine of its class in Japan, and an S-3000-series superminicomputer. Fujitsu, which developed the operating system with its U.S. joint-venture partner, Amdahl Corp., is the first Japanese company to come out with the Unix operating system on a mainframe computer.

"Unix is going to become one of the most important standards in operating-systems software in Japan," says Yuichi Murano, a computer industry analyst with Dataquest Japan Inc.

Hitachi planners are sticking their necks out even farther. "Top managers at Hitachi now feel that in the future Unix will be the major operating system in Japan," says a Hitachi executive.

Hitachi, previously one of the most ardent of the IBM-plug-compatible manufacturers, is putting its money where its port is. Last July, the company put on the market a $15,600 Unix-based minicomputer, the E-7100. Some 50 of the E-7100-linked work stations have already been sold.

Needs a standard. It is perhaps ironic that the Japanese are seeking to make a standard out of Unix. Some analysts point out that Unix, of which some 30 different versions exist, is itself in dire need of a standard.

Over the years, Bell Labs has released innumerable updates of the original version IV, including versions VI, VII, 32V, and System III, which integrates 32V, Programmer Workbench, and Version VII. Then Bell Labs came out with System V, Release 1.0, and last year offered Release 2.0. As if that were not confusing enough, numerous clients have created their own versions, the most famous being Berkeley 4.2BSD (commonly called Berkeley 4.2), which was developed by the University of California at Berkeley.

Nor is the Unix operating system all things to all users. For all its years in existence, it still has plenty of bugs. For one, it is weak on number crunching. "Unix has a long long way to go before it will be used heavily in data processing, banking, and process control," says Fujitsu's Tomioka.

Users also report that Unix has security problems. "The worst thing about the operating system is its security and file recovery," says Tomioka. This weakness sometimes results in files dissolving into the beyond. He is quick to point out, however, that those weak points are now "being enhanced."

And there is still a dearth of nontechnical applications programs for the general consumer. But most industry analysts do not see that as the ultimate weakness. Says the Yankee Group's Christiansen, "Applications are honey to bears. Put in a good installed base and they'll come."

Fostering wider use. In spite of the problems, Japanese computer makers have good reason to hitch their wagons to Unix. Bell Labs, in a gesture of openness designed to foster its wider use, in 1974 began licensing the Unix operating-system source codes to its customers. This move has allowed clients to add to or alter the system as their needs dictate. Such a feature has been especially attractive to Japanese firms that became computer literate when good Japanese-language application programs were scarce or nonexistent.

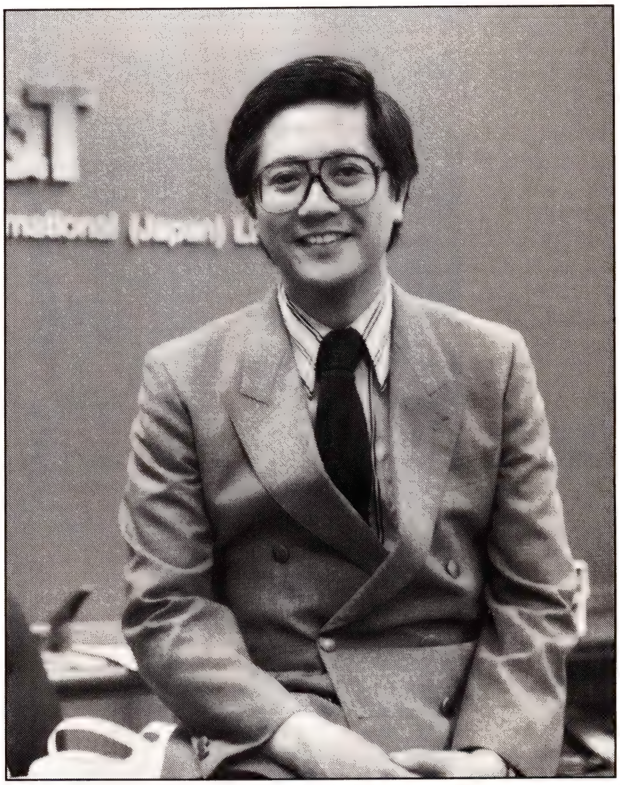
Though the current wealth of Japanese-language application programs on the market is changing the way Japanese companies approach software, many of them still prefer to tailor their own company-specific work-station software applications rather than run standard programs. Says Christiansen, "The fundamental strength of Unix is that Japanese firms now have the operating system and tools to develop what they need: screen displays, language, and data bases."

The fact that the customer can juggle operating-system resources is especially useful when running a graphics-heavy language like Japanese. The thousands of kanji characters each require 2 bytes of memory to process and need at least a 16-bit data path to handle the load.

For years, Japanese computer engineers have had to learn to float Japanese-character applications on top of an English-language-based operating system. Access to the source codes means they no longer have to wait around for U.S. engineers to get around to developing Japanese-language applications packages for them.

And the Bell Labs operating system is written in C, one of the most widely known computer languages in Japan. Unix was introduced in Japan in 1976 and, just as in the U.S., it was licensed to key universities, among them the leading Tokyo University and Tokyo Institute of Technology.

Unix's Programmer's Workbench, generally run on Digital Equipment Corp.'s VAX superminicomputers, has become one of the top software writer's programs in Japan, and has raised scores of software-engineering students. And, as computer makers know well, engineers don't soon forget their tutors. That pool of graduating engineers is a made-to-order client base. "Everybody knows Unix," says the Hitachi manager. "That is the biggest reason why it is becoming dominant in Japan."



Power player. Office automation and the need for powerful software is an advantage for Unix, says Makoto Asoh, manager of software licensing for AT&T Unix Pacific Co.

The trend toward power in office automation is also playing to Unix's advantage in Japan, says Makoto Asoh, manager of software licensing at AT&T Unix Pacific Ltd., the licensing agent for Asia. Office automation, claims Asoh, is moving more toward systems that require coordination, such as local-area networks and multiuser systems.

However, MS-DOS, the leading personal computer operating system, is made for the single user. AT&T's answer is Xenix, recently released in an updated form by Microsoft Corp. for use in multiuser work stations.

Japanese industry is not the only eager Unix customer. Last April, the Ministry of International Trade and Industry started a five-year effort to coordinate researchers from private industry to work on various software development programs.

In the Japanese government's rush to make the country's computer industry software-independent, MITI has chosen Unix as its primary software tool and standard. Most of MITI's research and development programs for computer-aided design and work stations will be Unix-based, says Masaya Yasui, assistant director of the ministry's Data-Processing Promotion Division.

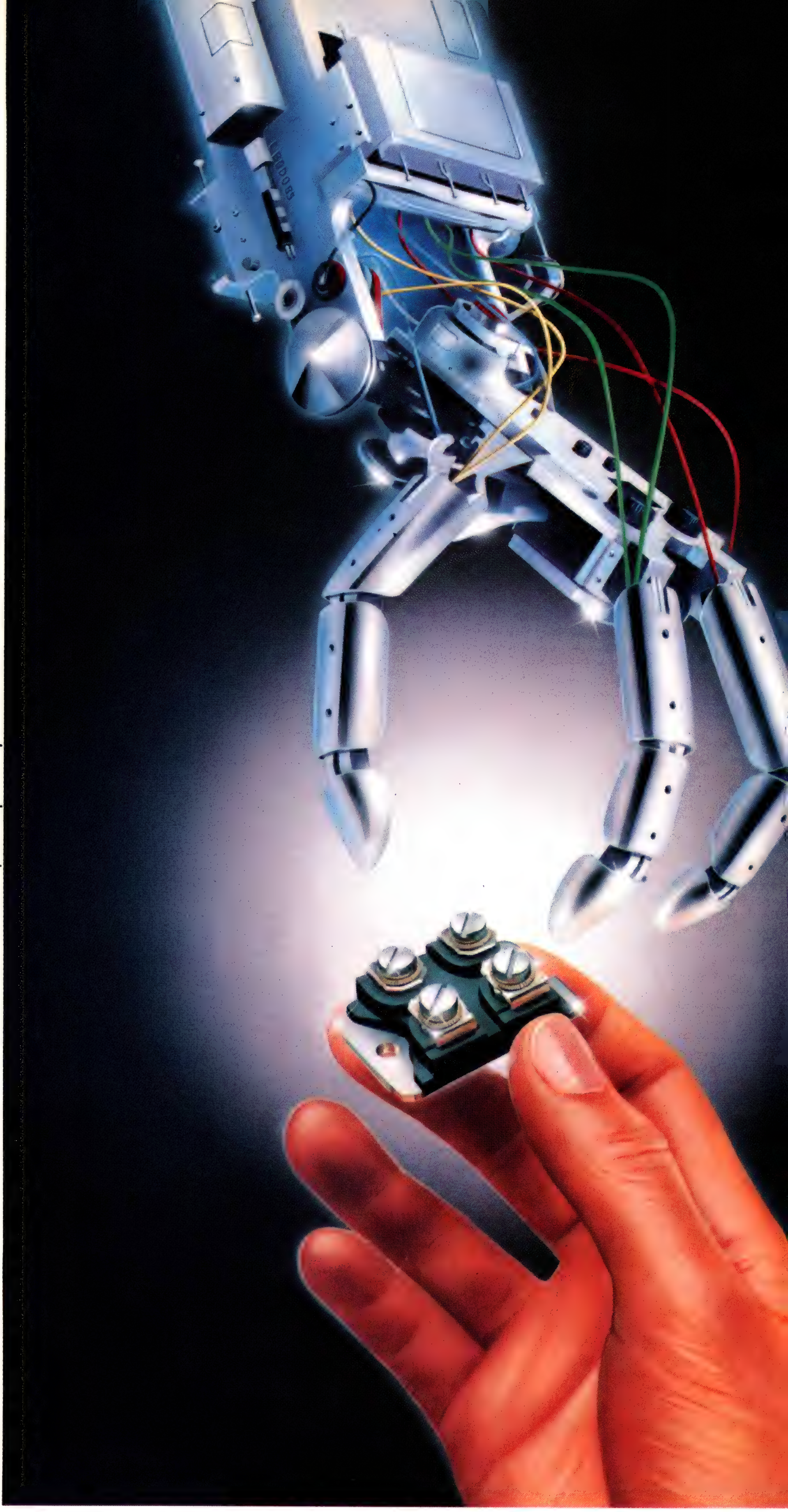
"It is really necessary to develop a software standard and Unix is excellent for software development and R&D," he says. Partly to help Japanese industry build that standard, MITI is pumping $100 million into a major software development program over a five-year period.

Nippon Telegraph & Telephone Corp., the newly privatized telecommunications giant, is also negotiating on behalf of six Japanese computer companies to come to an agreement on a Japanese Unix standard. NTT is asking AT&T to accept its recommendations on character codes, language related commands, kanji-character input and output, and editors. Asoh of AT&T Unix Pacific predicts, "I expect we'll accept their suggestions soon."

It is too early yet to predict whether the Japanese will be successful in developing an industrywide software operating-system standard based on Unix. But initial signs are encouraging. For example, since opening its Tokyo office last July, AT&T has cut its licensing procedures down from six months to a matter of weeks. And the number of source-code licenses for central processing units has shot up 61% in the last year, compared with about 40% for the U.S. Unix market.

Fujitsu, which hopes to sell 50 systems in the next three years, has received dozens of requests for information from potential customers in the past few weeks.

Still, despite their best efforts, Japanese makers will have a hard time breaking away from the shadow of Big Blue. IBM offers Unix for several of its computer systems, ranging from the IBM PC to mainframes. ☐



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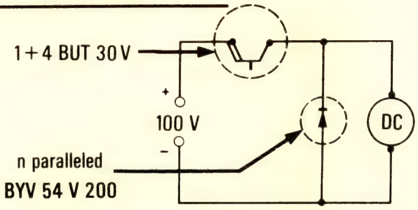

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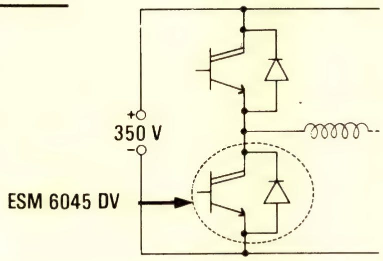
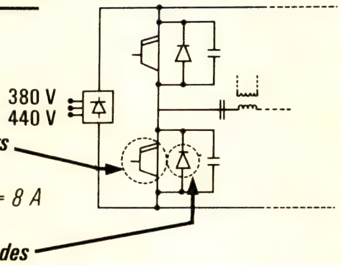


ESM 6045 DV Darlington with fast recovery antiparallel diode

V_{CEW} = 450 V $I_{C(sat)}$ = 50 A at $I_{B(sat)}$ = 1 A

RESONANT CONVERTER



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$I_{F(AV)}$ = 2 x 30 A t_{rr} = 50 ns

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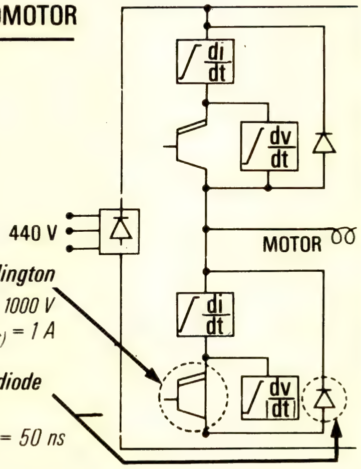


ESM 6045 AV Darlington

V_{CEW} = 450 V, V_{CEV} = 1000 V

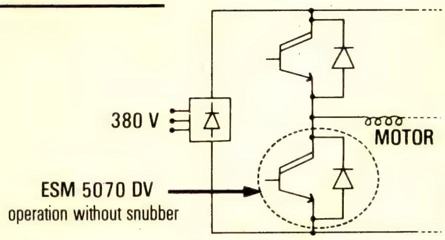
$I_{C(sat)}$ = 50 A at $I_{B(sat)}$ = 1 A

BYT 230 PIV 1000 diode

$I_{F(AV)}$ = 2 x 30 A

V_{RRM} = 1000 V t_{rr} = 50 ns

5 KVA - 8 KHz - AC DRIVE



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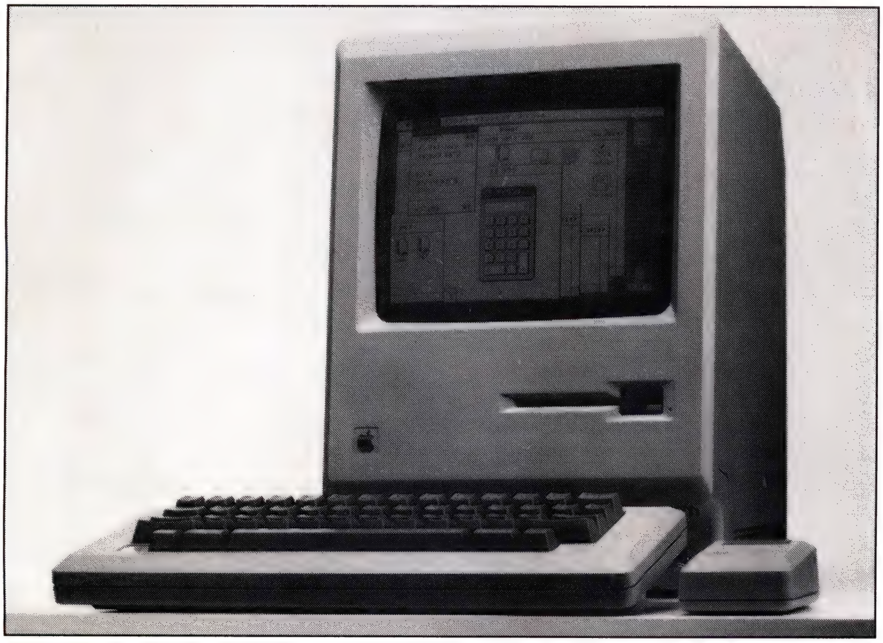
APPLE TRIES AGAIN TO BLAST OFF IN JAPAN

A textbook case in how not to do business in Japan, Apple Japan gets a new president, new software, and a new marketing strategy

Tokyo

Apple Computer Inc. has already gone into the history books as one of the most outstanding examples of American entrepreneurship—despite its current problems in the U.S. market. Yet few examples of American business failure overseas are more dismal than that of Apple Computer Japan Inc.

Apple Computer's Japanese history is a textbook case of how not to do business in Tokyo. Besides having gone through three distributorships since 1978, Apple has been trying to peddle an English-language software-driven product to a people who, despite their best efforts, are not proficient in English. Sales reflect the problems and resistance: Dataquest Japan Ltd. estimates that last year Apple Japan sold fewer than 10,000 units in a personal computer market of 1.09 million.



Adaptation. As part of a drive to adapt its products to the Japanese culture, Apple Japan will market a Macintosh that allows the use of Japanese characters for word processing.

Right stuff. All that is changing, claim Apple executives in Tokyo. Last summer the subsidiary's former president was shown the door and Robert D. Cory stepped into the breach. Cory, 35, certainly has the right stuff, Silicon Valley style; with an MBA from Stanford University, he has worked for SRI International, the Boston Consulting Group, and Atari Inc.

Cory is adding muscle to the Tokyo operation by bringing in more Japanese salespeople, with plans to double the staff to 40 by next fall. He has also kicked off a major new marketing strategy aimed at universities and key corporate accounts.

More than the organization is being rebuilt. Apple engineers are now developing Japanese-language software programs for the Macintosh and Apple II. Just last week Ergo Software Inc. in Tokyo, which has been working with Apple in Japan, announced a Japanese-language word-processing program for the Macintosh.

That is just an appetizer, says Ken Krugler, one of the top software engineers on the Macintosh team, who is directing the adaptation of Apple's machine for the Japanese market. The next product, out by year end, will be a truly Japanese-language productivity tool, the KanaMacintosh.

This heart-and-mind transplant is bringing about an important change in the Tokyo office. When he first visited Apple's Japanese operations last fall, recalls Cory bluntly, "Apple Japan was not Apple." Management's decision making was authoritarian and top-down, rather than participative and hands-on.

Employees relate stories of the former president retiring to his spacious rosewood office and remaining cloistered all day. Krugler agrees that the wind has shifted: "The Apple office in Tokyo is beginning to look like Cupertino," with boxes filling the hallways and piled in the executive offices. "We're definitely turning it around."

Perhaps just as important, Cory is not looking back: "As a company, we started in January," he says. "Apple Japan now really feels like a startup." For something to succeed in the Apple organization, someone must crusade for an idea. Cory is crusading for the Apple cause in Japan. And he is getting support from the highest levels in Cupertino. Apple has dispatched one of its top salespersons, Fred Scherrer, who spent eight years in Japan, to head the sales team there.

Apple cofounder and chairman Steven Jobs, who recently completed a two-week tour of Japan, is turning more attention there. "After a couple of false starts, we are finally happy with our distribution system in Japan," he told reporters last month.

Yet Cory faces some massive obstacles. Though it ranks as the No. 2 personal computer maker in the U.S., Apple's $1.5 billion in sales last year is still small compared to the Japanese giants it is taking on. NEC Corp., which holds 45% of the personal computer market there, had consolidated sales of more than $8 billion in 1984. That is not to mention other billion-dollar companies like Fujitsu Ltd. and Sharp Corp. Even in its home market, Apple has not fared that well against the huge IBM Corp.

Kiss of death. But neither is IBM doing so well in Japan. Apple's U.S. nemesis is slipping in its No. 2 ranking in mainframe computer sales and has grabbed little more than 2% of the low-end Japanese personal computer market with its kanji-capable JX model, oriented toward the local market. When IBM canned the PCjr last month, it also gave the JX the kiss of death—the JX runs on PCjr software.

"It is not exactly like Bambi meets Godzilla," says Mark Kopinski of Sanyo Securities Corp., Tokyo, referring to Apple's prospects. "It will be an uphill battle. But at least they have a chance."

Not everyone shares that optimistic view. "It will be difficult," says Yuichi Murano, an industry analyst with Dataquest in Tokyo, about Apple's future in Japan. Murano notes that sales of the Macintosh in Japan by the end of last year had not even reached 1,000 units. "It is a pretty dark situation," he says.

Murano cites several reasons for Apple's lack of success in Japan. One is the sales distribution channels. Apple's main distributor is Canon Inc. But Canon, a leading copier maker, "has no personal computer image," he says. Nor does

Canon have the strength of an electronics conglomerate, or *keiretsu,* to ensure Apple's survival in the market, Murano says. If an organization doesn't line up with one of the powerful *keiretsu,* it is “really tough to do business in Japan,” he points out.

Canon also sells its own personal computer, which competes to some degree with Apple's.

Ad cited. Another problem is the company's marketing and advertising approach, says Murano. One ad, for example, that featured a Buddhist deity holding an apple (an ad for which Apple actually won a local newspaper award) was inappropriate, he believes. Murano adds that, “In the U.S., Apple is known as the American Dream, but in Japan, nobody knows what that stands for.”

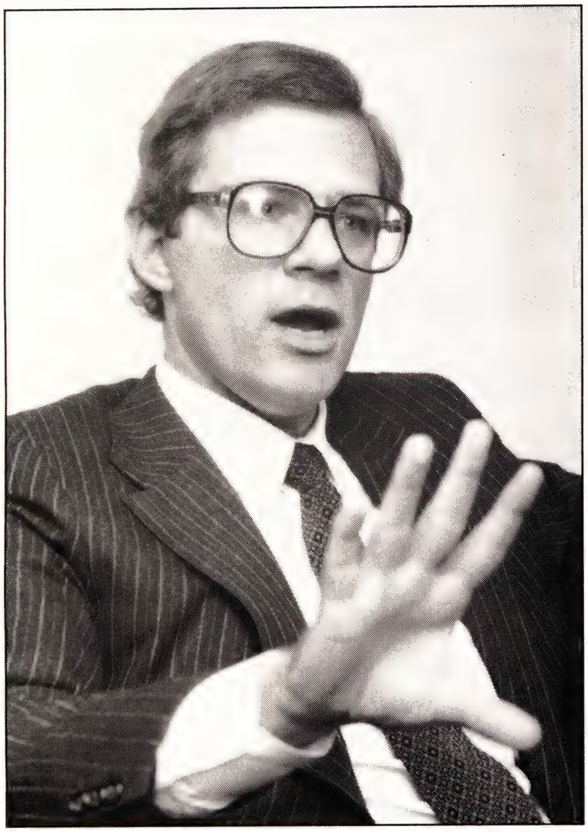
Then too, Macintosh has had trouble competing in price. For $3,000, a customer can get a low-end Mac or a faster 16-bit NEC 9000 series machine with a hard disk, Murano says. Price is one reason that students who five years ago cut their computing teeth on cheap but dependable pirated Apples are now running NEC machines, without moving on to the real thing.

Apple itself appears undaunted by the Japanese silicon jungle. The first step toward “localization” of the software support has been to develop a Japanese word-processing program (Japanese uses Chinese characters, called kanji, and native phonetic characters, called kana) that requires a fundamental change in the way the microprocessor handles the characters. An 8-bit data path is sufficient for the average Roman-language alphabet and all accessory keys, but a Japanese word processor, which must handle more than 2,000 characters, needs a more powerful 16-bit data path.

At the heart of the new program is an attempt to maintain the same software code that drives the many English-language Mac programs, while patching in a Japanese-character capability, explains Krugler. With a kanji window loaded into the program through a special conversion code, the user can obtain a kanji capability for character input and printing.

The trick will be to modify the system software stored in the Macintosh's read-only-memory chip to change the runtime environment permanently, he says. Japanese character parsing—that is, sorting out the proper kanji character from a list of homonyms presented on the screen—is usually done manually on the screen. Krugler is trying to get the system software to do most of the parsing work.

“An input window appears on the screen, into which the user types kana characters,” he says. The user can do a minimal amount of editing after finishing the text input. This parsing system is 100% correct 50% to 80% of the time. Krugler claims the system is “pretty hot. It is the best out there for kanji parsing.”



Settling in. Instead of shuttling between Cupertino and Tokyo, Apple Japan president Robert D. Cory will soon move to Japan.

All of this parsing takes power and memory—qualities that the Mac system has long been strapped for. Apple is now marketing 128-K and 512-K Macs in Japan, but the real tool will be the Hyperdrive—a Macintosh fitted with a 10-megabyte internal hard disk that features extra-rapid conversion, an important quality for a system that will have an overlarge dictionary, Krugler says.

The Hyperdrive, made by General Computer Corp. of Cambridge, Mass., will form the basis of the true Kana-Mac, he says. That, coupled with a 300-dots/in. laser printer (being developed in the U.S. by Adobe Systems Inc.), will form a product that is two to three years ahead of anything now on the Japanese market, he says. Apple will market it in the $4,000 range (with one laser printer being shared by an average of seven computers), about the same price of the APC 3, NEC's most popular 16-bit office computer.

Marketing blitz. Having just completed a marketing blitz aimed at the foreign business community in Japan, Apple is now following up with a major two-pronged drive toward large Japanese corporate and university accounts. Apple is building a consortium of major universities in Japan, as the firm has done successfully in the U.S. (where Apple holds 50% of the educational market), to offer discounts to students in the hopes of getting them hooked on its machines.

Though Apple officials initially are optimistic about their chances, they admit that problems exist. Besides legal and cultural differences, the logistics of setting up such a consortium are more difficult because Japanese university departments tend to be more independent in nature than those in the U.S.

In keeping with Apple's general plan to develop more credibility and visibility in the business market, the company hopes to have 10 to 12 large corporate accounts within the next few years. Apple hopes to reach sales of $100 million in Japan in three years. Sales manager Scherrer is optimistic because he says sales jumped 30% in the last two months alone. *–Jonathan Joseph*

APPLE COMPUTER INC. IS NOT AMONG THE MARKET LEADERS IN JAPAN

	1983 Unit Shipments	Market Share	1984 Unit Shipments	Market Share
NEC Corp.	305,000	46%	535,000	46%
Sharp Corp.	115,000	17%	185,000	16%
Fujitsu Ltd.	88,000	13%	180,000	15%
Toshiba Corp.	48,000	7%	65,000	6%
Hitachi Ltd.	34,000	5%	57,000	5%
Mitsubishi Electric Corp.	25,000	4%	40,000	3%
Sanyo Electric Co.	24,000	4%	38,000	3%
Others (including Apple)	16,000	2%	62,000	5%
Total	655,000		1,162,000	

Note: Market share figures may not equal 100 due to rounding off

SOURCE: DATAQUEST JAPAN LTD.

KNORR TYPIFIES SIEMENS' NEW CAN-DO ATTITUDE

Munich

By the end of the decade, Jürgen Knorr wants Siemens AG to attain a leading position in semiconductor technology, on a par with top-ranking firms in Japan and the U.S. But as the newly appointed vice president for semiconductor manufacturing and product development in the firm's Components Group, Knorr faces an uphill battle.

Yet he's confident his firm's financial clout, engineering resources, and newfound determination will make it a contender in world markets. The Munich firm is by far the country's biggest electrical/electronics producer, with total sales last year of nearly $17 billion.

As the first step the company has taken in the *Aufholjagd*—a buzzword in German industrial circles meaning "the catch-up race," Knorr cites the Mega project. It entails developing, together with N.V. Philips of the Netherlands, 1-Mb memory chips by 1987 and 4-Mb versions by 1989 [*ElectronicsWeek*, Oct. 29, 1984, p. 28]. Knorr also wants to strengthen production of power and optoelectronic devices, as well as "emphasize high-speed bipolar logic integrated circuits, and push CMOS technologies."

Special markets. Further detailing his product philosophy, he adds that, "We intend to stay out of the mass market for components and, instead, stress the customer- and applications-specific circuits business." This means gravitating toward special ICs for telecommunications, data processing, measuring and control, and entertainment applications. He especially foresees business opportunities in the last area.

Knorr, 52, exudes a true "can do" spirit. He's one of the new breed of Siemens managers determined to transform their company from the slow-moving, unimaginative organization it was a few years ago into a fast-paced, innovative high-tech firm.

Along the way to the goal of making Siemens a top semiconductor house, Knorr wants to help keep sales growing at an above-average pace. Of last year's total components business of around $860 million, nearly 60% was in semiconductors. Sales of ICs alone came to about $270 million and are expected to go to more than $700 million by the end of this decade.

As for the current state of the semiconductor market, Knorr thinks the West German business cycle is still heading down while the U.S. market is stabilizing. At Siemens, the latest book-to-bill ratios are 0.9 for discrete devices and 0.7 for ICs.

Major player. Jürgen Knorr, one of the new breed of Siemens managers, wants his firm to play a major world role.

This has led to hiring freezes and production trimmings at Siemens. Knorr says Siemens will continue spending on research and development, however, "because in the long run we expect the semiconductor business to grow at rates well above 20% a year." *–John Gosch*

COATES BANKS ON INDUSTRY SLUMP FOR BETTER SALES

Sunnyvale, Calif.

Vincent Coates is one of the few people who figures the tenacious slump in the semiconductor industry may actually help his business rather than hurt it. Coates is founder, president, and chairman of Nanometrics Inc. of Sunnyvale, Calif., a maker of chip-measurement and -inspection systems.

"We don't expect a glorious year like last year," admits Coates, who raised $7 million for Nanometrics in a public offering last December and ended fiscal 1984 with net sales of $30.1 million, an increase of 52% over 1983. Yet he claims that despite the slump, "all the major semiconductor manufacturers are barreling forward. Sophisticated device completion is their principal mode of generating increased profit. The companies who finish the good stuff first will get those higher profits."

For that reason, Coates says, continued investment in research and development in all phases—including wafer-measurement and -inspection systems—is the semiconductor industry's "light at the end of the tunnel." If that light is fluorescent, Nanometrics may have put it there. At Semicon, the company introduced a linewidth measurement system called Nanoline 5, which uses fluorescent light to make precise measurements of submicron features down to 0.5 μm. Major semiconductor manufacturers had heard about the product before its announcement, and Coates says they are beating on Nanometrics' door to get the units.

Squeeze is on. "The big companies are squeezing geometries," says Coates. He hopes the company's breakthrough into submicron geometries with both the Nanoline 5 and its new, stable, high-brightness electron source called the Zee gun, for use with the company's scanning electron microscopes, will help Nanometrics maintain its market share.

Nanometrics' performance in the U.S. market may be moot if the export situation doesn't improve, however. Coates says 50% of Nanometrics' business is from overseas—Europe, Japan, and increasing amounts from Taiwan, Korea, and Singapore. The company opened a wholly-owned manufacturing and engineering subsidiary, Nanometrics Japan K.K. in 1984. "We're also receiving major orders from the People's Republic of China," he says, but reports that the company can't deliver them because export restrictions have indefinitely tied up delivery of several systems to Chinese government plants that want to begin production of semiconductors.

"It's a bad and sad situation," laments Coates, insisting that export-license problems could be smoothed out without endangering national security. The Semiconductor Equipment and Materials Institute lobbies Congress sporadically to break what he terms an "ideological jam," as opposed to a logjam of high-tech exports—but with little success. It's a problem he sees as crucial to the long-term success or failure of the U.S. semiconductor industry. *–Denise Caruso*

R&D need. Coates of Nanometrics believes the semiconductor industry must invest in research and development to snap its slump.

BOTTOM LINES

Lotus forms Japanese subsidiary

Lotus Development Corp., the world's largest independent producer of microcomputer software, announced its intention to form Lotus Japan, a wholly owned subsidiary to be based in Tokyo. The company will develop, market, and support Lotus products in Japan. "Lotus Japan will take advantage of the rapidly expanding Japanese microcomputer market and help fill the gap for high-performance, analytical products designed to meet Japanese needs," says Lotus president Jim P. Manzi. To help its new offspring, Lotus has signed a letter of intent with Kanri Kogaku Kenkyusho Ltd., a Tokyo software firm, to form a partnership to adapt existing software such as 1-2-3, Symphony, and Jazz to the needs of Japanese professionals, as well as to develop new software aimed at the Japanese market.

GE Information Services lays off 400

Approximately 400 marketing, sales, and technical positions were eliminated by General Electric Information Services Co., a division of General Electric Co. About 40% of the layoffs occurred at the Rockville, Md., headquarters. The move, part of a restructuring effort, was aimed at shoring up the company's competitive position by focusing on high-growth, specialized businesses. According to GE Information Services president Walter W. Williams, "Specific application businesses that we will more aggressively target include office communications, automated clearinghouse services, supplier and dealer systems, international trade, and a portfolio of electronic data interchange markets."

Rosscomp gets new financing

Streaming tape-drive maker Rosscomp Corp. has obtained new working capital through a financing agreement with a group of venture-capital shareholders. Under terms of the agreement, the venture capitalists have agreed to buy $750,000 of convertible secured subordinated notes. Another $250,000 will be available to the company from certain venture investors when Rosscomp meets yet-to-be-determined benchmarks. The investors can acquire an additional $500,000 in notes before the end of this year. The notes bear interest at 2% per annum over the prime rate.

Wyle's first-quarter sales drop

Sales at Wyle Laboratories for the quarter ended April 30 dropped to $71.3 million, from $93.1 million for the first quarter last year. Stanley A. Wainer, chairman, president, and CEO, blamed the losses on continued depressed conditions in the semiconductor industry.

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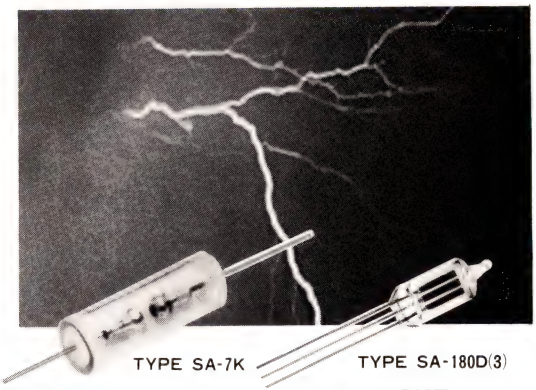

● *TYPE*

Type	Breakdown Voltage (V) DC	Insulation Resistance (Ω)	Maximum Surge Current (8 × 20us) KA	Life Times at 500A
SA-80SS	80 ± 10%	10^{10} min	1.0	1000
SA-200SS	200 ± 10%	10^{10} min	1.0	1000
SA-80	80 ± 10%	10^{10} min	1.5	1000
SA-140	140 ± 10%	10^{10} min	1.5	1000
SA-200	200 ± 10%	10^{10} min	1.5	1000
SA-250	250 ± 10%	10^{10} min	1.5	1000
SA-300	300 ± 10%	10^{10} min	1.5	1000
SA-7K	7000 ± 1000V	10^{10} min	—	5000
SA-10K	10000 ± 1000V	10^{10} min	—	5000
SA-180D(3)	180 ± 10%	10^{10} min	2.5	1000

SA-180D(3) is a three electrode discharge tube.
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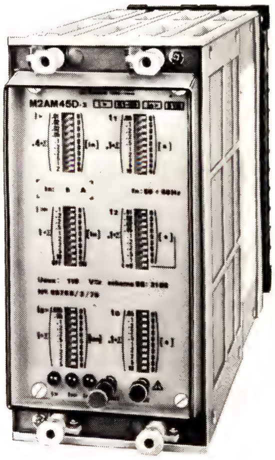

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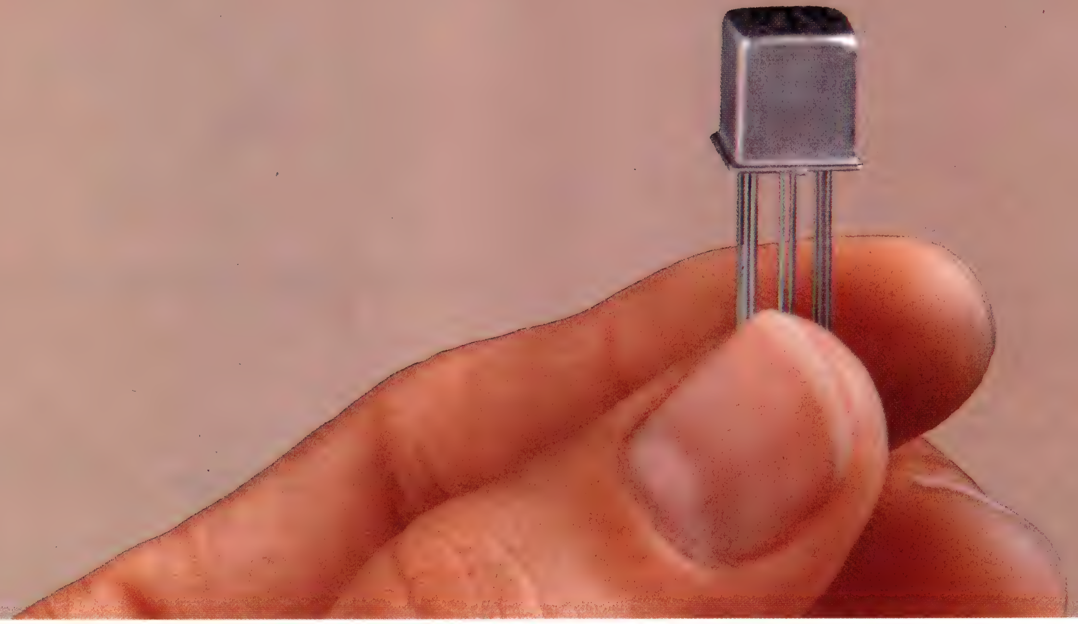

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DESPITE SLEEPY IMAGE, RELAY TECHNOLOGY MAKES STRIDES FORWARD

by Michael B. Rand

U.S. MANUFACTURERS TOUGHEN UP TO THE JAPANESE THREAT AS INDUSTRY LOOKS FOR STEADY BUT MODERATE GROWTH

Thanks to new materials, innovative packaging, and more automated manufacturing, today's relay has been substantially reduced in both size and cost. In other ways too, the basic electromechanical relay has changed rather dramatically during recent years, influenced in part by Japanese competition with the U.S. for market share and in part by new technology. Progress in the relay industry these days is marked by the ability to cultivate new applications and to develop a new generation of relays based on photovoltaics, integrated-circuit technology, and hybridization.

In its simplest definition, a relay is an electrically controlled device that opens or closes an electrical contact to affect the operation of other devices. Now, however, the definition encompasses solid-state and optoelectronic configurations with no moving parts. In any form, the relay's salient feature is its extremely high resistance when open and its very low resistance when closed, which provides excellent isolation.

The U.S. relay market now has strong competition from the Japanese, challenging such long-established relay names as Potter & Brunfield and Magnacraft. Their successful penetration into the market is demonstrated most clearly by the "sugar-cube" subminiature relays that can be mounted on printed-circuit boards. These relays, most of which are manufactured by NEC, Omron Electronics, Takamisawa Electric, Fujitsu America, and Aromat, constitute Japan's strategy for capturing a significant part of the market for general-purpose relays (Fig. 1).

"U.S. firms can't make general-purpose relays with the necessary precision and quantity. They didn't make the necessary investment but rather are buying relays on a private-label basis from Japan," says Toshihiko Yamamoto, assistant manager in the general marketing department of Matsushita Electric Works Ltd. (Aromat's Japanese parent).

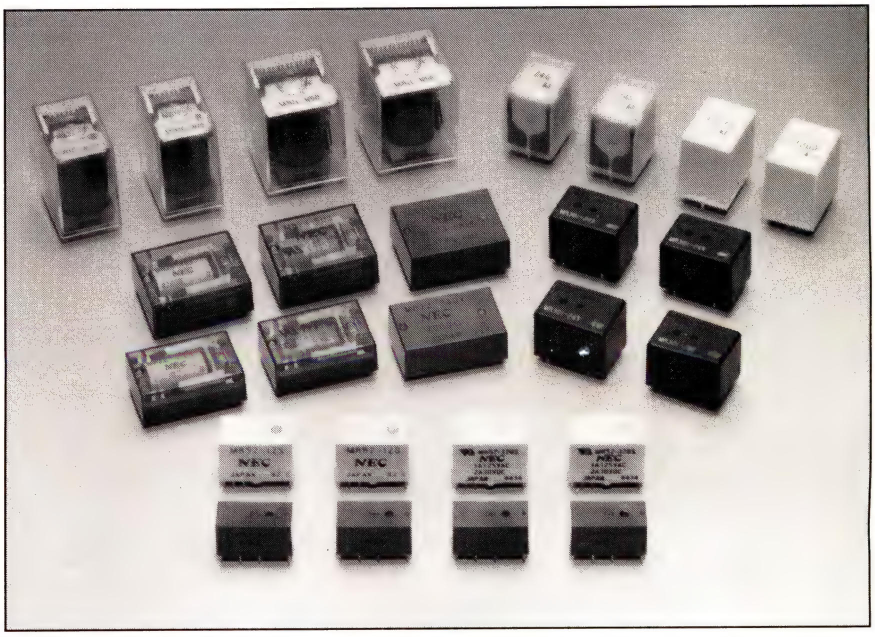
In response to the Japanese challenge, many U.S. firms are aiming at specialized niches of the relay market. Many firms believe it doesn't pay to tool up for high yield and a high degree of automation; most product lines are too small to justify the investment. For example, Norman Yudewitz, chief applications engineer at Magnacraft Electric Co., Chicago, agrees that although the Japanese excel in their ability to provide a low-cost high-quality device, he believes that the U.S. can meet or exceed any quality requirements and that quality doesn't necessarily require automation. A case in point: in the last four months, Magnacraft has shipped IBM Corp. an undisclosed number of relays with no defects.

Teledyne Inc., through its Relays and Solid State Products divisions, produces electromechanical and solid-state relays for both commercial and military use. The company is protecting its market position by patenting the manufacturing processes.

The Japanese manufacturers also sell under their own names and have won most of the the market for printed-circuit-board relays, telecommunications, and instrument controls. As a result, relay production in Japan is about 40 million units a month, of which 80% are pc-board types. Matsushita said last year's growth was about 30% and this year's will be about 10% to 15%.

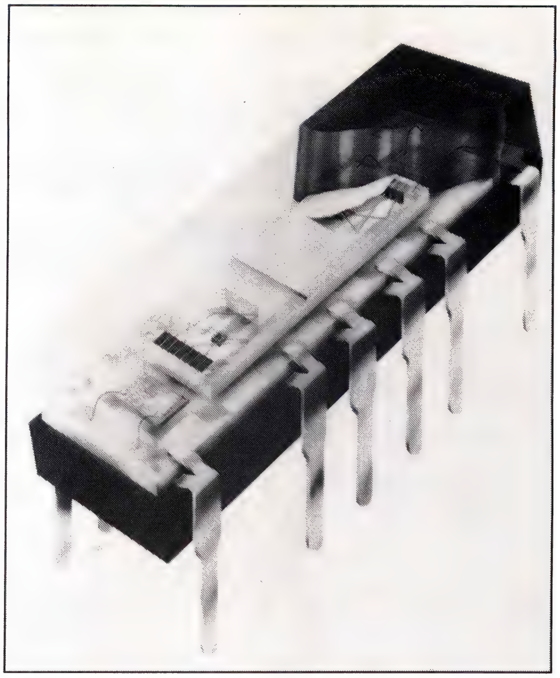
A conventional general-purpose relay is a basic coil-and-contact configuration designed to switch ac or dc up to 10 A. Although it is difficult to break the relay industry into clear-cut categories for statistical or financial analysis, some say that the general-purpose sector provides nearly half of the U.S. sales revenue in relays—more than $250 million.

One novel approach to modern relay design is from the solid-state-relay (SSR) sector, which accounts for roughly $50 million to $60 million in U.S. sales. Because many original-equipment manufacturers make their own solid-state relays, there is a captive market of between $100 million and $200 million that could be recaptured by the SSR manufacturers when prices come down. Such capabilities as superior packaging, better density, higher quality, and Underwriters' Labora-



1. Millions of minis. Most of the general-purpose relays used in North America are manufactured in Japan. One overseas manufacturer said production is currently 32 million units a month for the plastic miniature relays that can be mounted on printed-circuit boards.

tory approval make these relays more attractive, according to Bill Collins, product manager of International Rectifier Corp.'s Crydom Division.



2. Photovoltaic relays. The latest relay from International Rectifier's Crydom Division is a photovoltaic device designed as a solid-state replacement for the electromechanical reed relays. It boasts smaller size, lower operating power, longer life, and higher speed.

Collins hopes to grab a share of this potential gold mine with the company's photovoltaic relay. This is a solid-state design that achieves electro-optical isolation with a light-emitting diode, which energizes a photovoltaic generator consisting of a series connection of silicon photovoltaic cells. The photovoltaic generator produces up to 5 V when receiving radiation from the LED (Fig. 2).

The photovoltaic relay is also being focused to take a bite out of the reed relay's market share in the fields of process control, data acquisition, multiplexing, automatic test equipment, and telecommunications equipment by virtue of its new attributes. The five most important features of the photovoltaic relay are: a lifetime that is about 10 times that of a reed relay; speed; low thermal voltage generation; low pickup power (typically 5 mW); and miniaturization. A reed relay typically has an operating-power characteristic of 100 mW per pole. A sensitive relay has been described throughout the industry as one that will pick up with less than 10 mW.

Crydom's photovoltaic relay turns on a proprietary bidirectional MOS FET—a BOS FET—which is essentially two MOS FET transistors back to back. The BOS FET (for bidirectional-output-switch FET) provides a considerably more versatile replacement for mechanical contacts than do either thyristors or bipolar transistors, because the MOS FET does not have an offset voltage when turned on, in contrast to the 0.6-V threshold-voltage drop in a thyristor-type component.

By incorporating a FET rather than a thyristor into the output, the relay provides the versatility most conventional solid-state relays (SSRs) lack: the ability to switch dc signal levels normally relegated to electromechanical relays. The relay can also switch ac from power frequencies through the radio-frequency range. Figures of merit for the device include 10^{10} minimum operations (10 times the present reed relay), the capability for 25-μs switching, and a 200-nV maximum thermal offset.

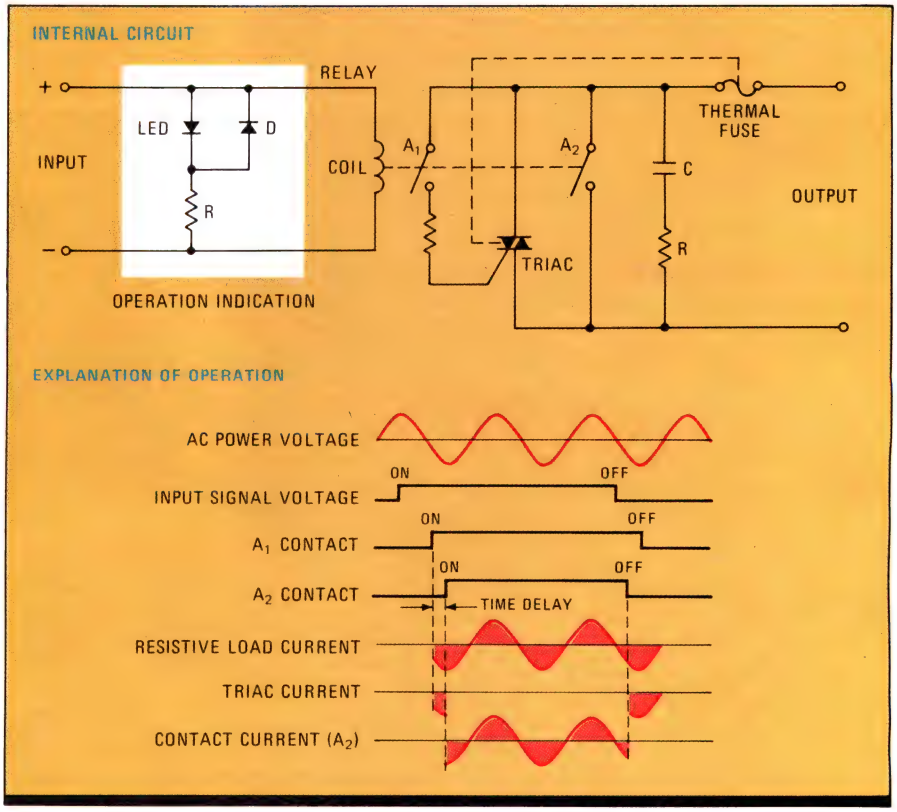
An SSR uses semiconductor circuits: it is based on thick-film technology rather than on electromagnetic operation. Most conventional SSRs combine an optocoupler input that triggers a thryistor-type output device—either back-to-back silicon controlled rectifiers or triacs—typically used to switch ac loads.

Only about 10% of sales in the SSR market are credited to the SSRs with MOS FET outputs. These relatively new "signal-level" SSRs are currently the second biggest shaker in the industry, behind the subminiature plastic pc-mountable relays. Because of stepped-up production and sophistication of manufacturing processes, the Chipswitch solid-state relay, Crydom's original relay using soft-start technology, is available at $3 each in large volumes. The soft-start relays, or the zero-crossing feature of the Chipswitch that is also incorporated into the photovoltaic relay, combines bipolar and MOS circuitry to turn on the relay at 0 V or zero energy and turns off the relay at the 0-current point. This minimizes line disturbances and radio-frequency interference that can cause problems.

Although International Rectifier doesn't divulge revenue figures by division, John Deith, vice president of sales and marketing, says that sales for International Rectifier, of which Crydom is one of many divisions, "will increase 30% and 50% over the next two years, respectively."

Most general-purpose relays available today were designed, marketed, and made for specific industries such as ATE, telecommunications, and industrial control, although they are typically lumped into the catchall category of general-purpose relays.

Aromat Corp., a Matsushita subsidiary in Mountainside, N.J., described to *ElectronicsWeek* the evolution of the relay



3. Modern hybrid. In the H-OP relay, a polarized relay is combined with a semiconductor to provide the merits of both: high switching capacity of the semiconductor and the low heat generation of the electromechanical relay. The relay comes in 5- and 10-A versions.

since its early days. The first generation of relays comprised the early hinged types or conventional electromagnetic relays. In the late 1960s, the introduction of the polarized relays that respond to the polarity in addition to the magnitude of the energizing current represented the second generation. Most of the 25 billion relays in the world are nonpolarized, or first-generation, relays. A product manager in the industry noted that if all first-generation relays were replaced by polarized latching relays, the equivalent of five medium-sized nuclear reactors could be shut down because of the saving in power consumption.

The newest wave uses second-generation electromagnetic relays in combination with thick-film technology to produce a switching device with a degree of programmability built in. This intelligent control makes it possible for the relay to control operation of various peripheral equipment by responding to signals from a programmable large-scale-integration device such as a microprocessor, programmable logic array, or other LSI-compatible logic circuit or device.

Smart relays

This newest generation of relays—called IC relays by Aromat, currently the only company manufacturing them—has little competition and a large potential market. But, as with the newest generation of solid-state relays, the market has not reached its sales potential. This hybrid relay is a combination of a polarized electromagnetic relay and a custom IC. The smart relays, as they are sometimes called, can serve energy-saving applications or provide signal-processing functions—set, reset, toggle, monostable, and so on, depending on the model of relay. The relays in the IC family are designed to simplify design, thereby eliminating other interface components, saving board space, and ultimately saving money.

Most of the companies *ElectronicsWeek* queried believe that there is not much of a market today for smart relays, although Sigma Instruments Inc., Braintree, Mass., and General Instrument Corp.'s Clare Division, Chicago, are said to have similar smart relays. However, plenty of others are thinking about developing an equivalent device to avoid missing the bandwagon.

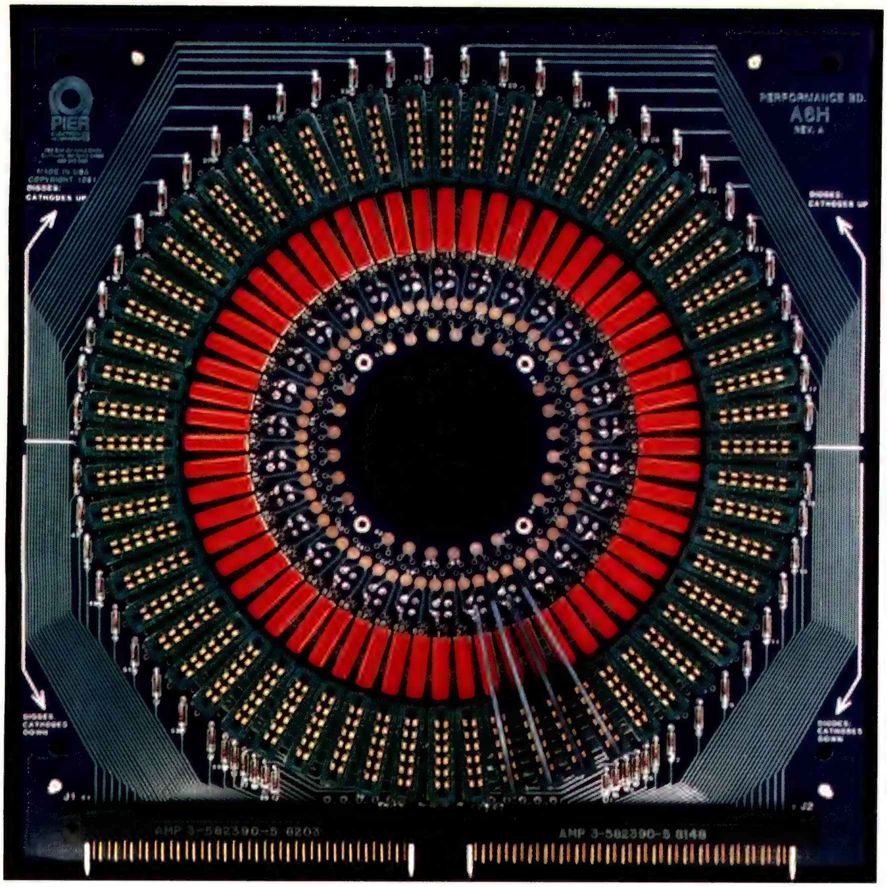
Aromat's H-OP power relay is not an IC relay; it is a unique hybrid made up of a modern electromagnetic relay and a semiconductor triac. The hybrid power device makes use of the merits of both semiconductor and mechanical switching relays while avoiding their respective disadvantages. The main advantage borrowed from the mechanical relay is its low on-state power-dissipation characteristic; it borrows from the semiconductor triac the ability to suppress contact arcing while contact transfer is taking place. The electrical life of the hybrid is about the same as the life of the solid-state relays.

When the relay receives an input signal, contact A_1 is turned on after initial relay action, causing load current to flow in the triac (Fig. 3). Contact A_2 then closes after some time delay, causing load current through that contact. When there is no input signal, contact A_2 is off after relay release time, causing load current to flow into the triac. When contact A_1 is turned off, the load current becomes 0 and is cut off by the triac. This operation makes the H-OP resist inrush current better than a mechanical relay and exhibit a longer life span; it is focused toward automatic vending machines, electric heating devices, office-automation equipment, and a host of other applications.

The first quarter of this year has been sluggish for most relay companies, but some manufacturers don't feel the crunch as much as their competitors. The reason, according to an Aromat representative, is that "we have been trying our best to meet our customers' technology requirements, and not just selling by price. Therefore, we are not affected greatly by economic trends because we provide a service."

Aromat's manufacturing facility in Cupertino, Calif., is

4. Manufacturing in Hometown, U.S.A. Unlike the manufacturing techniques used by the Japanese, Struthers-Dunn Inc. employs specialists to test its relays with custom-designed test instruments. High-quality relays for the military account for more than half of the firm's revenue.



5. SMD reed relay. The 9200 series surface mountable relay from Coto Corp. has been designed for automatic test equipment in the very large-scale-integration industry. The reed relay is available in four configurations.

100% automated and uses robotics at the state-of-the-art facility. By contrast, although Struthers-Dunn Inc. uses automated manufacturing processes only at its New Hampshire facility for production of commercial industrial relays, the company says that practice is changing.

The differences in manufacturing and sales practices between Japanese companies, such as Aromat and Omron, and seasoned U.S. firms—Struthers-Dunn, for example—are indicative of the contrasting views of manufacturing and marketing that pervade today's U.S. relay industry (Fig. 4). About 60% of Struthers-Dunn's revenue comes from military relays, a market that usually involves low quantities and high prices, and the rest of its business is commercial, which includes a broad line of relays. "Our forte is versatility of product in the industrial and military sectors," explains Bill Capewell, vice president of sales for the Pitman, N.J., firm.

Military market is secure

To retain its market share in the industry, the company plans to expand its lines of time-delay, military, and hermetically sealed relays. Capewell acknowledges the Japanese influence in the high-volume, low-profile, plastic relays that are flooding the U.S., and says, "We don't have the money like AMF and Potter & Brunfield to get into the general-purpose sector. It's a big nut to crack."

Another fact that helps ameliorate the well-funded and aggressive foreign incursion is that military-relay manufacturers are generally immune to foreign competition because of security reasons and the U.S. government's reluctance to purchase relays overseas. Struthers-Dunn is becoming more involved with polarized and latching relays, which are said to have "feature-69." Feature-69 describes a new relay frame that includes a permanent magnet, allowing the relay to handle heavier dc inductive loads with longer life.

Bill Poisson, sales and marketing manager for Coto Corp., Providence, R.I., believes the relay industry is alive and well—not, as many believe, a mature, sleepy industry destined for no more than minimal growth. Coto is one of the three largest producers of reed relays in the U.S. The firm has an aggressive research and engineering group continually improving designs and incorporating new features into its reed relays for new applications.

Moreover, it is taking Japan's cues on automation and reliability; the company recently developed a more advanced method of construction for its 9200 series surface-mountable reed relay (Fig. 5), which is aimed at the electrical test-and-measurement field, biomedical electronics (patient monitoring and analysis, such as the electrocardiogram and defibrillator), and the ATE and telecommunications industries.

"Our company's fresh approach to adopt quality in manufacturing capabilities will hopefully stave off Japanese efforts to penetrate the reed market," says Poisson. He sees 1985 as a soft year for a number of reasons. He believes that the relay industry pretty much follows the trends in the semiconductor industry and that one of the reasons for 1984's boom was double ordering by personal computer manufacturers and semiconductor users for their test equipment.

Coto is planning to market surface-mountable reed relays for transmission-type switching that is used in ATE for the VLSI market.

Besides the new inroads being paved by the solid-state-relay sector, as evidenced by Crydom's photovoltaic relay and its cousin the Chipswitch (a power-frequency ac-line-voltage switch), the trend is to use polarized latching-type relays when an electromechanical relay is required in a design.

The polarized relay is essentially an electromechanical relay that has a permanent magnet incorporated into the electromagnet. This design increases the attractive force of the electromagnet, which in turn decreases the required size of the relay to facilitate the same contact force.

There are two kinds of polarized relays: the conventional single-side stable type, which functions only when voltage is applied to the coil, and the latching type, which does not release the contact when coil voltage ceases. To release the latched contact in polarized relays, either a voltage or a reverse voltage is applied to a second coil. Many small relays are polarized for high reliability and low power. Contact pressure is high because of magnetic pull, and the latching function allows operation from a single pulse. "Compared with 15 years ago, the percentage of polarized relays has increased. U.S. manufacturers mostly only make polarized types for military applications," according to a Matsushita representative.

However, many applications don't require the latching capability or extra contact force generated by the addition of a permanent magnet, explains Yudewitz of Magnacraft. Sometimes power consumption just isn't a problem, and the operating environment may preclude the use of polarized devices. "It basically boils down to a tradeoff when selecting a relay: what do I gain by going with this relay versus what do you have to give up," he says. One major factor is that polarized relays have typically cost more than their nonpolarized counterparts. □

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SPEECH SYSTEMS

PHILIPS'S ADAPTER BOX SIMPLIFIES CODING, EDITING

DEVELOPMENT SYSTEM BASED ON PERSONAL COMPUTER DISPLAYS SPEECH ELEMENTS GRAPHICALLY

Today, synthesized speech can be heard increasingly in elevators, trains, and cars, providing warnings and messages formerly announced by humans or indicated by displays. For the visually handicapped, telephones that speak the numbers dialed and talking typewriters and ovens greatly assist day-to-day life. In the future, developments such as the incorporation of speech output in a compact-disk, read-only-memory-based navigation system could revolutionize route planning on the road or on the factory floor.

Much of the work associated with speech synthesis involves generating the speech codes for the synthesizer. Although manufacturers of synthesizers that model the vocal tract offer speech-coding, that service is usually performed on a mainframe computer, making it an expensive and time-consuming proposition for the customer, who must travel to and from the manufacturer.

To solve this problem, N.V. Philips of Eindhoven, the Netherlands, has built on the ever-increasing presence of microcomputers in the home as well as their use in business and technical applications, to create a speech-development system for use with a personal computer. The system also presents a display of the synthesized speech (Fig. 1).

The fact that coded speech parameters can be displayed graphically could signal a revolution in speech editing, now that the process has been simplified so that it can be learned in a day. By using a personal computer, it is possible to generate software (or speech codes) at home or at the office in just a few hours, the company says.

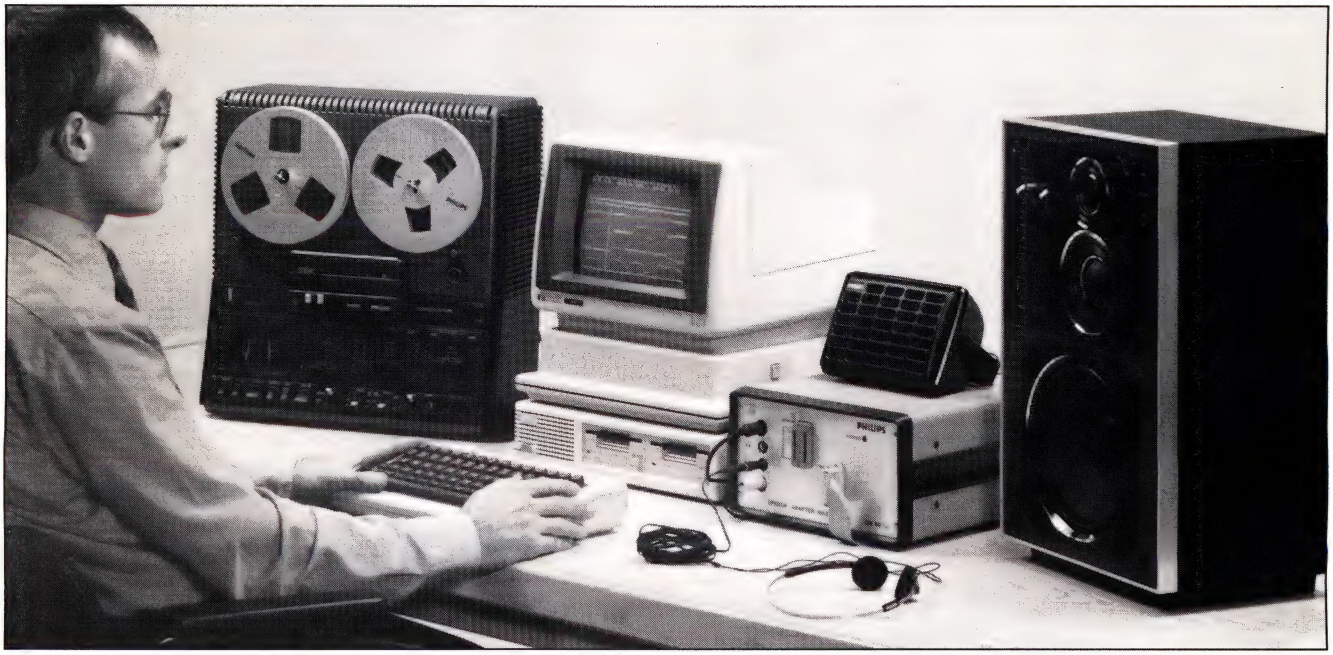
According to Menno ten Have and Jos den Ouden of the Philips Central Applications Laboratory, the system is a hardware input/output device, called the speech adapter box (or SAB) that includes two 3½-in. microdisks, which store all the software for analyzing, editing, and coding speech. Currently, the SAB is available only for the Hewlett-Packard Co. 9816S; software for another make of personal computer will be available soon.

Making editing easier

Editing speech to improve the intelligibility of the synthesizer output and minimizing the data rate without loss of speech quality are specialized tasks. This is because editing systems usually display the speech to be edited on a screen in the form of complex tables of coded speech parameters, which are difficult for an untrained person to understand. The new system was developed to overcome these shortcomings.

In addition to the benefits of a graphical representation of

1. Micro talk. Philips' speech-development system includes a hardware I/O for the HP 9816S computer and software for analyzing, coding, and editing speech. Two 3½-in. floppy disks contain the required software. Graphic speech-parameter displays are possible.



speech parameters, the speech-development system features:

- Speech-interactive operation, with which synthesized speech segments or single speech frames can be pronounced and checked for quality.
- Software that is arranged in eight modes for optimum user convenience.
- Menu display of all commands.
- Keystroke confirmation of all commands that destroy data before the commands are executed.

The procedure for generating speech codes for a typical formant synthesizer begins by recording the desired message. The process is completed with the evaluation of the encoded speech sample in the system in which it will be used (Fig. 2).

After the speech to be synthesized has been recorded on tape, the Sample mode is used to sample and digitize the recorded speech, check the amplitude of the digitized speech segments, and select speech segments for analysis, the next stage of speech coding. The sampled speech is stored in memory arrays (used for sampling, parameter input and edit, and coding) and can be displayed (Fig. 3) or made audible.

Converting samples to parameters

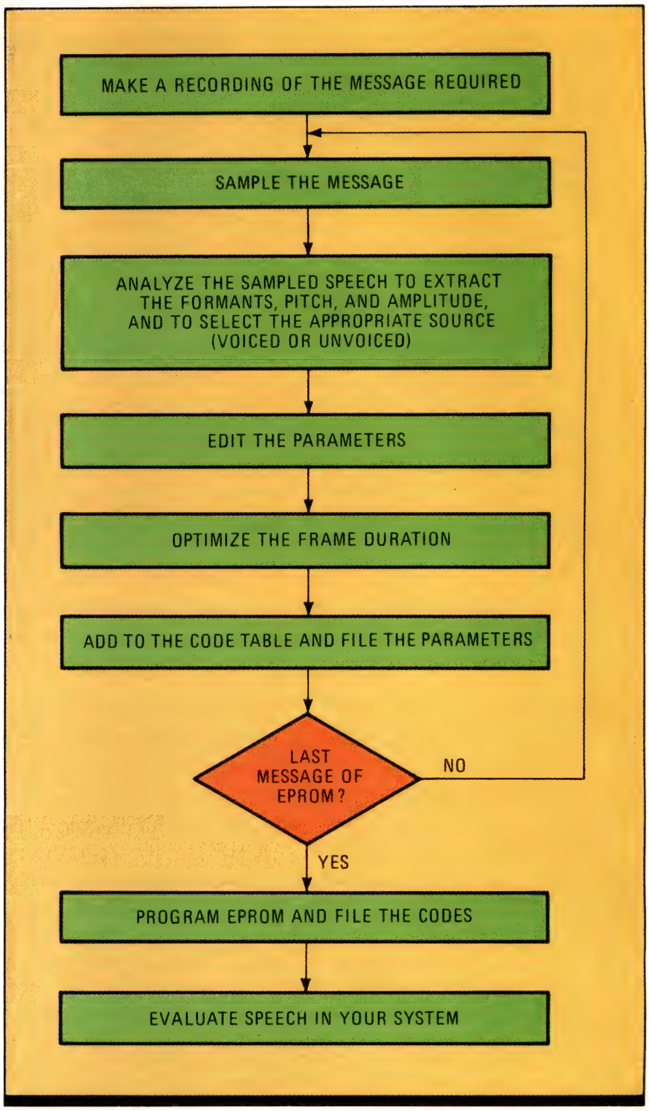
In the Analysis mode, speech samples are converted to speech parameters that can be used by the synthesizer. The voiced and unvoiced parts of speech are identified and the pitch of the voiced sounds is extracted together with the four formants and their bandwidths (see "Human speech production mechanism," p. 46).

In addition, the amplitude of the sounds is determined. Each parameter is rounded to the nearest one that can be produced by the synthesizer. Using quantized speech parameters that can be coded reduces significantly the amount of data needed to recreate speech. In general, one second of speech takes about 50 seconds for analysis when using the HP-based system.

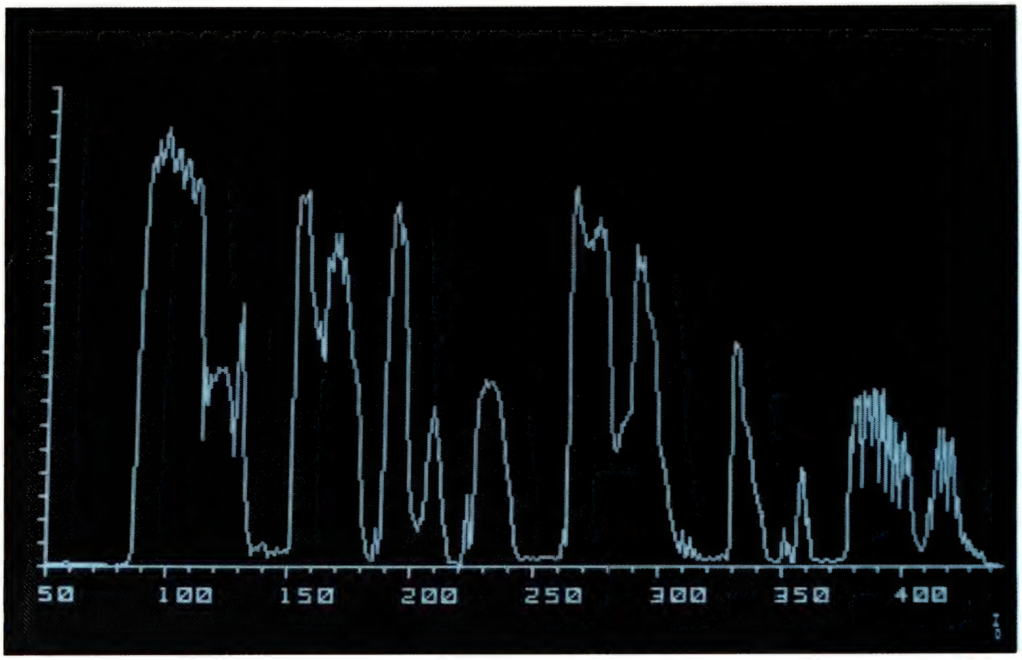
After analysis, the quantized speech parameters are stored in the input-parameter memory and are ready for editing using the Parameter Edit mode. Samples, input and edit parameters, and codes are stored in the personal computer's random-access memory. Commands are available to make copies of the parameter and code memories on disks and to program the code memory in an ultraviolet erasable programmable ROM.

For editing, a copy of the parameters is loaded into the edit memory. Parameters are displayed graphically on a visual display unit (Fig. 4), so that the user can easily identify any errors from analysis.

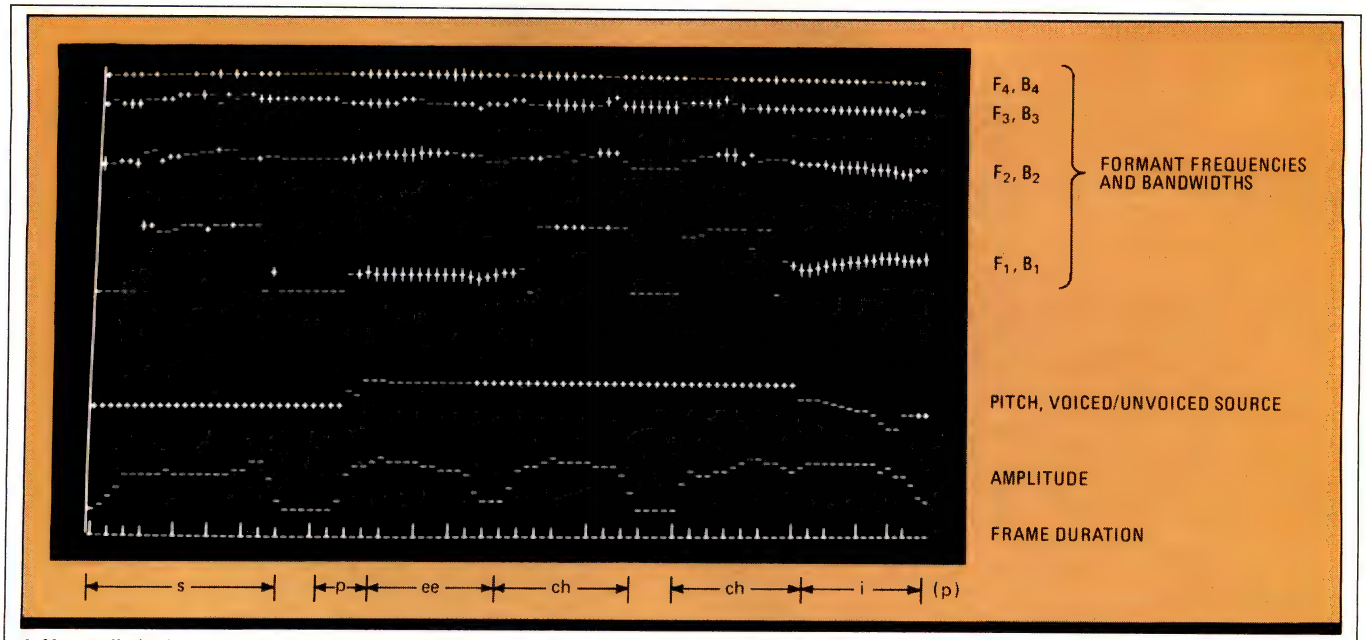
The speech can also be improved by altering the pitch contour, amplitude, and rhythm. Words and sounds can be isolated or connected. The amount of


MAKE A RECORDING OF THE MESSAGE REQUIRED
SAMPLE THE MESSAGE
ANALYZE THE SAMPLED SPEECH TO EXTRACT THE FORMANTS, PITCH, AND AMPLITUDE, AND TO SELECT THE APPROPRIATE SOURCE (VOICED OR UNVOICED)
EDIT THE PARAMETERS
OPTIMIZE THE FRAME DURATION
ADD TO THE CODE TABLE AND FILE THE PARAMETERS
LAST MESSAGE OF EPROM?
NO
YES
PROGRAM EPROM AND FILE THE CODES
EVALUATE SPEECH IN YOUR SYSTEM

2. Code maker. Code-production software is arranged in a modular fashion. Once the synthesized speech has been recorded, it is sampled, analyzed (for several different parameters), edited, optimized, and finally added automatically to the existing code table.



3. Word picture. A display generated from an HP 9816S equipped with the Philips speech system provides visual presentation. Analysis takes about 50 seconds for each second of speech. Pauses are not analyzed, so complete phrases can be investigated at about 40 seconds per second of speech.



4. New talk. In the analysis mode, parameters are loaded into the edit memory. The speech pattern can be modified for a closer match with the source parameters. Pitch, contour, amplitude, and rhythm are adjustable: word sounds can be isolated, separated, or moved closer together.

HUMAN SPEECH PRODUCTION MECHANISM

All speech is derived from a periodic signal source or a noise source. During speech, the source and its amplitude are always varying, sometimes quite rapidly. To produce speech, the lungs build up air pressure, causing the previously closed vocal cords to open (Fig. a). As a result, pressure drops, the vocal cords close, and pressure builds up again. This mechanism excites the vocal tract with a periodic train of sawtooth pressure pulses.

Sounds generated in this way—for example, the vowels A and E—are called voiced sounds (Fig. b). The frequency of this periodic signal is commonly referred to as pitch. The vocal tract can also be excited with the vocal cords always slightly open, so that air passes continuously through them, causing turbulence in the vocal tract. Sounds produced in this manner, such as sibilants, are called unvoiced sounds.

Situated above the vocal tracts are the pharyngeal, oral, and nasal cavities, which shape the spectrum of the generated sounds. The nasal cavity is accessed through the velum. Speech synthesizers do not simulate the velum and the nasal cavity; consequently, for speech synthesis, the vocal tract can be analyzed as if it were an acoustic tube. This tube is almost closed by the vocal cords at one end and is open at the other, where mouth radiation takes place.

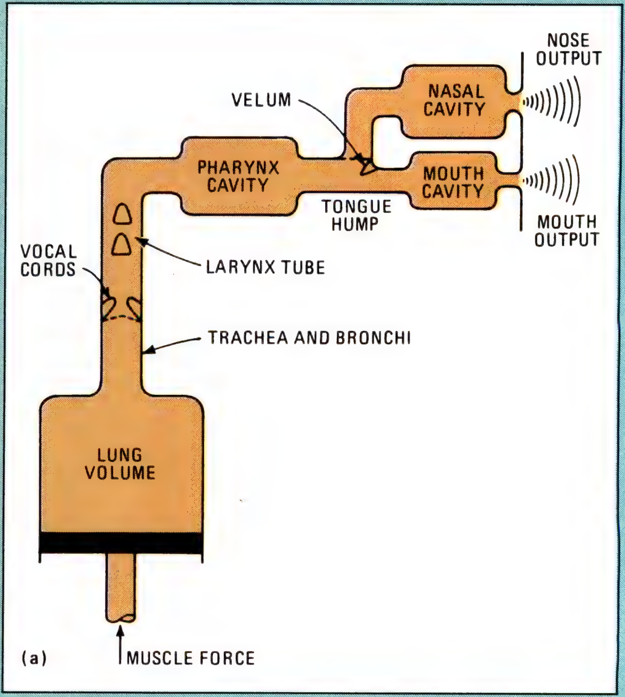
The frequency response of a tube with constant diameter is characterized by a number of equally spaced resonances (Fig. c) at frequencies given by

$$f(n) = 340(2n-1)/4L \text{ Hz}$$

where $n = 1,2,3,4,\ldots$, and L is the tube length in meters. These resonant frequencies are called the formants of the vocal tract. Within a 4-kHz bandwidth (typical of most synthesizers), four formants are present for a male voice ($L = 0.175$ m) and three for a female voice, because of a woman's shorter vocal tract.

During speech, the shape of the vocal tract is constantly changing. For example, when an E is pronounced, the pharyngeal cavity is large while the oral cavity is small. This increases the frequency of the second formant. When an A is pronounced the situation is reversed, reducing the separation between the first and second formants. Each formant is further characterized by its bandwidth. The first two or three formants are the most important for intelligible speech; most formant synthesizers generate and shape four or five formants.

Until a few years ago, communication between man and machine had been mainly in sign language from visual displays; audible communication was restricted to cries of alarm emitted by beepers, bells, and buzzers. Voice communication was impractical because analog storage of speech required the use of moving parts such as tape drives, which unduly prolonged the retrieval time; digital



data to be stored can be reduced by increasing the length of speech segments when the speech parameters are constant or changing at a constant rate. Editing mistakes can be corrected because the unedited speech is always available in the input-parameter memory. The audio commands are a feature of the parameter-edit mode. They enable the user, at any stage of editing, to hear and compare the speech represented by the contents of the input and edit memories with the original sampled speech stored in the memory array.

Compressed speech code

Compressed speech code is generated from the data in the parameter-edit memory using the Code mode. The speech codes are stored in a memory array with an address map at its head to indicate the number and size of the different utterances. The order of the utterances in the code map can be optimized for the application. Utterances can be deleted if no longer required, and can be made audible even at this stage. Speech parameters or codes can be stored on 3½-in. micro-floppy disks using the File mode.

The system can program four industry-standard EPROMs with automatic verification of the EPROM contents against the code map (EPROM mode). About 50 seconds of coded speech can be stored on each EPROM. Programs for making backup disks, initializing disks (Media mode), and for modifying system parameters such as the audio sampling rate (Option mode) are available.

The requirements for a personal computer for this speech-development system are:

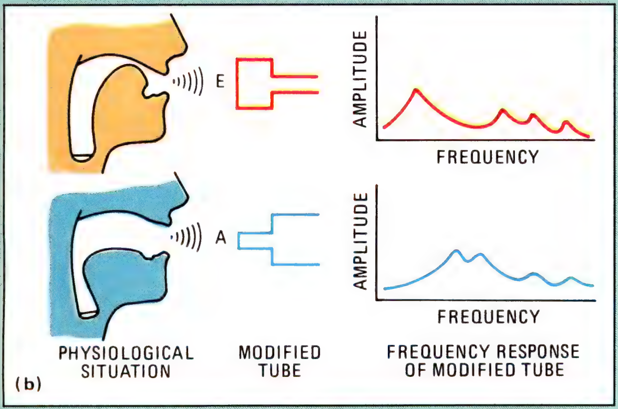
- Single-user single-tasking for stand-alone operation.
- Pascal compiler to ease program writing and assembler-programmable code linker for speed during analysis.
- IEEE-488 (or the European equivalent, IEC 625) bus interface for communication with the SAB.
- 512-K-byte machine RAM memory for storing the analysis and editing programs, sampled speech data, and the input and edit parameters representing, at any one time, up to 9 seconds of speech.
- High-resolution display for the graphics.
- Acceptable price.
- Reliable manufacturer with worldwide service facilities.

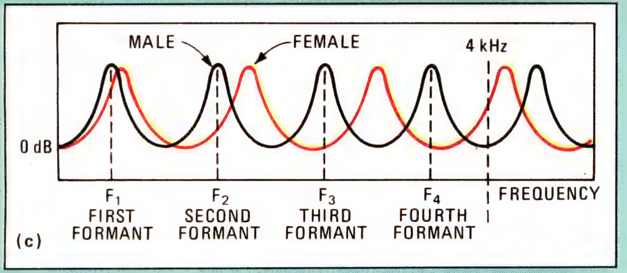
Of the personal computers available during the development of the SAB, the Hewlett-Packard HP9816S met all the requirements listed above. In addition, its 32-bit processing capability was considered desirable for fast execution of an autocorrelation routine that was used to extract the formant frequencies of speech. Experience with the current combination suggests that a machine with 16-bit processing capability could be used if coding speed is not essential. ☐

storage required handling an enormous number of bits. The development of speech synthesis techniques has dramatically reduced the bit rate and the memory required for digital speech synthesis, allowing inexpensive wideband voice channels between machine and man to be implemented.

Three main methods of generating speech are used in speech-synthesizer integrated circuits today: waveform coding, phoneme coding, and vocal-tract modeling.

In waveform coding, speech is sampled, digitized, and compressed by eliminating symmetrical redundancy and pauses in the digitized speech. The speech is then stored in a memory. To regenerate a sound, the process essentially is reversed, so the recreated sound closely resembles the original. Very high quality can be obtained when a high bit rate is used—up to 64 kb/s for a male voice. A disadvantage of waveform coding is the large memory required for even a limited vocabulary.


(b)


(c)

With the phoneme-coding method, spoken words are sliced into their constituent sounds (phonemes), which are stored in memory as a series of codes and reconstructed as desired. Phoneme coding offers very low data rates (typically 70 b/s) but generates poor speech quality.

For applications requiring a high-quality voice and a substantial vocabulary, vocal-tract modeling using linear predictive coding (LPC) is the most cost effective. In LPC, speech is sampled, digitized, and passed through a digital analyzing filter that shapes the voice-frequency spectrum. The filter is described by coefficients that represent either the shape of the vocal tract or the formant center frequencies and bandwidths of vocal-tract resonances.

An LPC synthesizer using the latter technique is commonly called a formant synthesizer. An advantage of a formant synthesizer is that the speech parameters controlling the filter have perceptual significance; that is, they are not merely coefficients but represent frequencies, bandwidths, and so forth. Furthermore, the parameters are fairly insensitive to quantization, which is essential if the amount of data to be stored is to be kept within practical limits.

For formant synthesis, a complex analysis algorithm is needed to generate speech parameters from the original speech. The pitch-detection part of the algorithm involves a search for periodicity in the speech, either in the frequency or the time domain. Both methods are sensitive to noise, which can cause octave errors or completely incorrect results. Once generated, all the parameters that control the filter are coded and stored in memory. To recreate speech, the appropriate codes are retrieved from memory, then sent to an electronic model of the vocal tract (inverse analyzing filter). A word can be pronounced by the synthesizer in a variety of ways by altering the vocal tract model.

Vocal-tract modeling offers excellent quality sound with low data rates. It does, however, require comprehensive analysis and editing of the speech to be recorded in order to improve the intelligibility of the synthesized speech and to minimize the data rate without loss of speech quality.

SILICON COMPILERS ADDS TWO VLSI DESIGN SYSTEMS

Single-user model sells for $165,000, while system supporting 10 costs $640,000

When Silicon Compilers Inc. introduced the Genesil 400 very-large-scale-integrated-circuit design system last October, the San Jose, Calif., company had something more than that machine up its sleeve.

The four-user Gen 400, based on a Digital Equipment Corp. VAX-11/750 superminicomputer, carries a hefty price tag of more than $500,000. "But not everyone has $500,000 or $700,000 to spend on a system," says Walter Curtis, vice president for marketing. So the middle-level, multiuser model 400 was released in part to test the market waters before the company expanded the Genesil line, he explains. And that is exactly what it is doing now.

As soon as Silicon Compilers was confident its 400 system was performing smoothly in the field, the firm was ready to adapt it to different computers. So within just a few months, it began and completed development on the two new members of the Genesil line: the single-user Gen 100 (below right), which is one of the first new products based on DEC's recently introduced Microvax II, and the multiuser Gen 500, an integrated data-base environment for up to 10 users.

The trick, Curtis says, was not really very difficult to pull off. "We purposely entered the market with a four-user model," he says. "We purposely held off putting Genesil on any other hardware platforms until we felt confident that we knew all the unknowns about our first entry. Now we're trying to broaden the use of the product on both the higher and lower ends."

Adapting the software from the 400's 11/750 hardware shell to the Microvax II-based Genesil 100 and the 11/785-based Genesil 500 was relatively simple, Curtis explains; the company was already familiar with DEC's Unix-based VAX machines, and their similar architecture made the job fairly easy. Adapting the silicon-compilation software to the 500 was particularly simple, Curtis says, because it was able to use the same instruction set and operating system as the 400. The 100's instruction set, although not identical to the others, is "extremely compatible," Curtis says; there are some technical deviations required by the smaller hardware shell, but he says they do not affect performance.

The Genesil line is designed to generate application-specific IC designs from high-level functional descriptions entered by the user. The advantage of these machines is that users do not need specialized IC-design experience because the computer—and not the user—is concerned with gate- and transistor-level details. That means the system can be used by designers in computer manufacturing, telecommunications, office automation, and military electronics—fields where such detailed work would normally have to be farmed out of the office.

"The initial response from IC designers is, 'This is a threat to my job,'" Curtis says. "But if you're an IC designer, this gives you even better leverage for custom VLSI design. [The machine frees the designer] to use his expertise in the really critical areas" of a chip, instead of wasting time and energy on less important details.

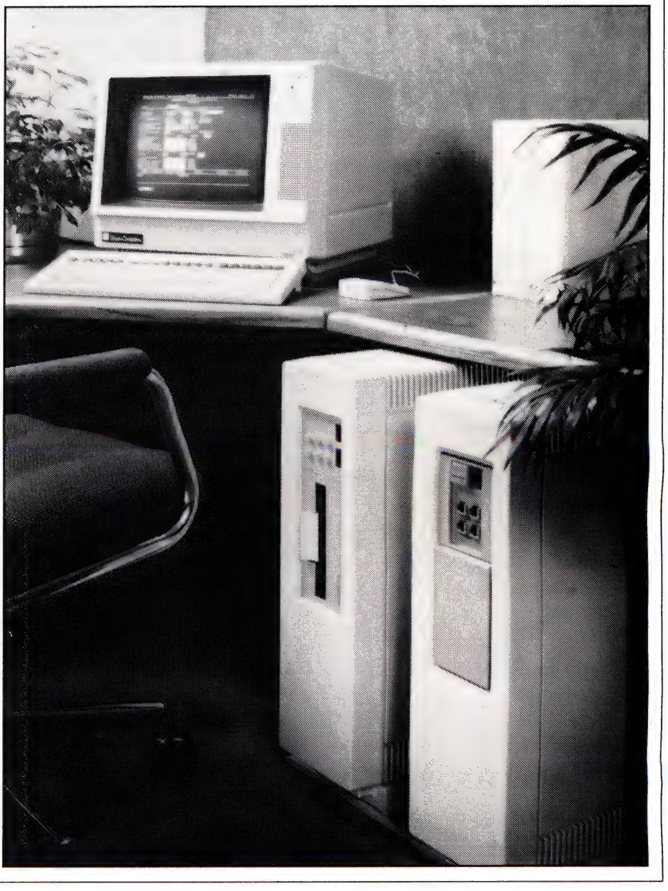
The three turnkey systems, which can be joined over an Ethernet local-area network using the TCP/IP protocol, accept a user-entered functional block diagram of an IC and generate timing and simulation models, power estimates, test vectors, and finished layouts. VLSI designs can be generated in either double-metal CMOS or single-level n-MOS, and a foundry-selection feature gives users the choice of the most appropriate chip foundry for the job. The system even helps the user determine the ideal package for a custom chip and what the optimal pinout should be.

All this is done practically as fast as the engineer can think. The system can determine a chip's dimensions while allowing performance and cost comparisons among different architectures, processes, and even chip-making foundries. The result, Curtis says, is "as complete a design as we know how to help a designer make." Users can design and redesign a chip, make comparisons on a number of variables, and decide on a design before ever committing themselves to potentially expensive—and even disastrous—production contracts.

Curtis recognizes that software for existing engineering work stations can do some of the things the Genesil line can do, but, he says, "We like to think we are cheaper, faster, and better. Right now, none of the [computer-aided design] tools out there allow the comparison and conceptual start [features that are on the Genesil machines].

"The whole idea is seeing what happens in silicon before you spend the money on production."

The $165,000 Genesil 100, which uses DEC's Ultrix version of AT&T Bell Laboratories' Unix operating system, has ample capacity for its memory-intensive application. The system



comes with 2 megabytes of RAM (easily expandable, Curtis says, and limited "only by DEC's creativity and what they can physically stuff in the box"), 184 megabytes of hard-disk storage, and a 95-megabyte magnetic-tape drive—the medium by which all the design information can be sent to the chosen foundry. Other features include a 1,200-b/s modem for communication with Silicon Compilers' technical support group (which will help users determine bugs and errors when the system is operating improperly) and an eight-port RS-232-C I/O interface, which is used for a printer, a plotter, and the standard 1,024-by-780-pixel Seiko color graphics terminal.

The Genesil 500, with a base price of $640,000 for a five-user setup, is expandable for up to 10 users. The top-of-the-line model includes a DEC 11/785 VAX system, 8 megabytes of RAM (also expandable), 450 megabytes of hard-disk storage, and a 1,600-bits/in. nine-track magnetic-tape drive. Also included is a pair of eight-port RS-232-C interfaces, a pair of 1,200-b/s modems, and the University of California at Berkeley 4.2 version of Unix.

Software function sets, which contain program information on either n-MOS or CMOS circuitry, are not included in the base systems. Users can purchase both sets or just one. The CMOS function set ranges in price from $30,000 for the model 100 to $105,000 for the 500. Prices for the n-MOS set are $20,000 for the 100 and $65,000 for the 500.

Although hard-core IC-design experience is not essential, some training is, Curtis says. A five-day training class at Silicon Compilers' San Jose facility, which costs $2,000 per attendee, serves that end. "We feel that training is absolutely essential for proper use of the system," he says. "You can be a good pilot, but if you don't know how to use that particular kind of airplane, you're going to have problems."

Aimed at smaller companies that do not have the resources to invest in $500,000 systems, the 100 is a solution for spread-out companies whose engineers are not conveniently located at a central site. Regardless of the specific market for the single-user model, Curtis says, "Our target is all the system engineers, plus all the IC designers that want to build custom VLSI parts. The market has yet to be defined," he adds, "but it's big. We don't even know yet how large it could be."

To reach that market, the company has unleashed its biggest marketing program to date: an 18-stop, worldwide tour to take the technology to the marketplace and demonstrate its capabilities. The company has committed what Curtis calls a "massive amount of bucks and a massive amount of people-hours" to the project, which includes several demonstration teams of eight or nine people. "It's fulfilling our educational role, to get people to know what silicon compiling is," he says. "Now it's time to shift into high gear. People aren't going to go to you; you've got to go to them." *–Tobias Naegele*

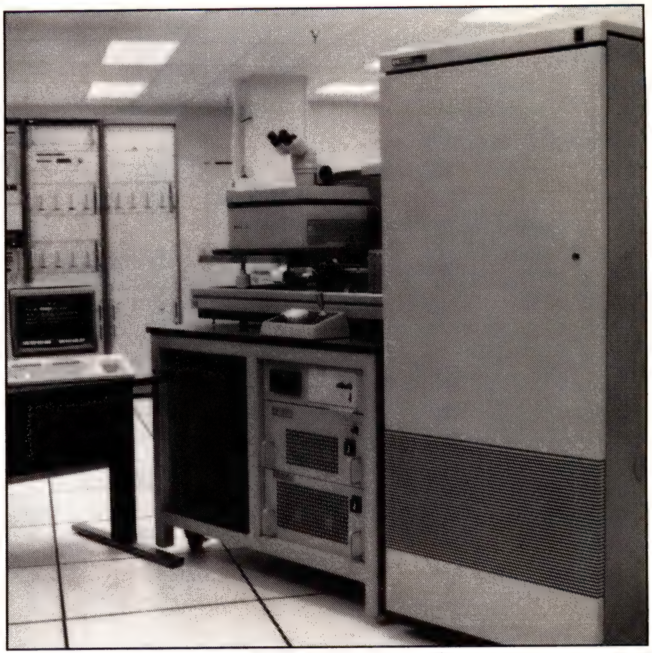
Silicon Compilers Inc., 2045 Hamilton Ave., San Jose, Calif. 95125. Phone (408) 371-2900 [Circle 338]

Memory test has drive-edge placement accuracy of ±600 ps

An application-specific modular software program can cut by 50% the time and effort required to execute tests on the HP 9430 memory-test system, its maker says. The compact system fits its computer, disk storage, and measurement tools onto a single rack and does not require a separate host computer for either program or test functions.

Its thorough and precise device characterization, the company says, allows manufacturers to reduce their measurement guardbands to improve yields. The system has driver-capacitor skew of ±400 ps and overall drive-edge placement accuracy of ±600 ps.

Calibration is automatic and typically takes 5 min. It should last for at least one year, the company says. Operating between 10°C and 40°C, the test system will meet worst-case specifications as long as it is operating at a temperature ±10°C from the temperature during calibration.



Tasks for developing test programs are grouped in individual modules: pin assignments, patterns, timing diagrams, and address descrambling are set up in independent editors. The modular approach, according to the company, results in simplified programs and permits test patterns and other settings to be used repeatedly when creating new test programs.

A basic system configured for testing 256-K-by-1-bit dynamic RAMs is priced from about $110,000. It includes the system controller, disk storage, a work station, and support services. A dual test-head system starts at about $130,000. Delivery is six weeks after receipt of order.

Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto, Calif. 94303. [Circle 340]

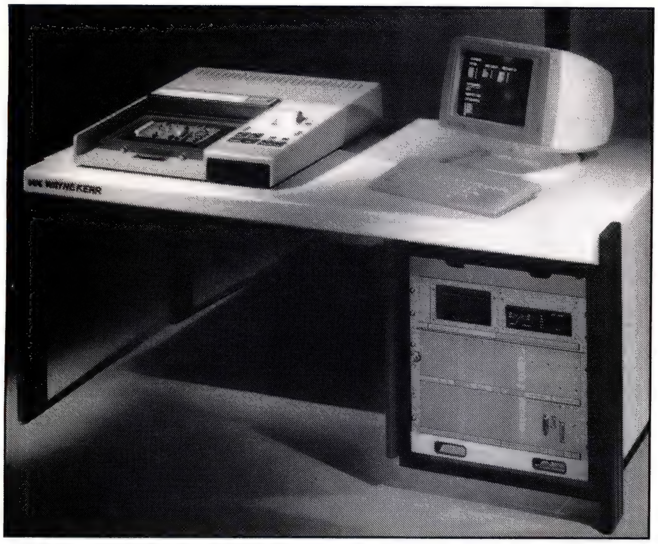
Modular tester also repairs and does off-line programming

The three components that make up the Model 8510 Extendable Automatic Test System—test station, repair station, and off-line programming station—make the modular 8510 a multipurpose machine. The test station, designed primarily for functional testing of analog and mixed analog/digital boards, performs real-time microprocessor tests, automatic bus-testing routines, and real-time PROM emulation. The repair station consists of a terminal, keyboard, and bar-code wand to access centrally stored fault information.

The optional off-line programming station allows program development in parallel to the other functions. It offers full syntax checking and can be used to develop applications programs for statistical and historical trend analysis. Programs can be generated automatically by linking the system to computer-aided-design equipment.

The test system also includes a 10-megabyte Winchester disk drive as well as a 1-megabyte floppy-disk drive, programs that can have up to 4,000 lines of Atlas test language, a 15-in. CRT, a modem interface, and the Atlas programming language, with its optional menu-driven interactive program generator.

With up to 448 test pins, the unit boasts an ac measurement range of 20 Hz to 200 kHz, an identical ac stimulus range, and



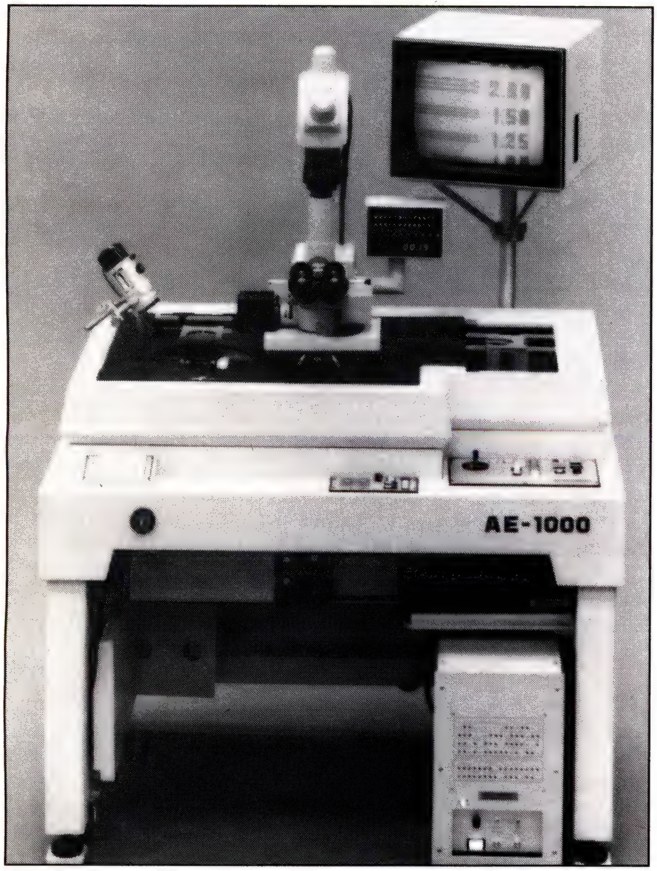
a dc measurement range of 100 μV to 64 V at 0.1% accuracy and a resolution of 1 μV. The system, which is priced from $70,000, is available in either desktop or portable configurations. Deliveries are scheduled to begin in August.

Wayne Kerr Inc., 400 W. Cummings Park, Woburn, Mass. 01801.
Phone (617) 938-8390 [Circle 341]

Wafer-inspection system does both total and random sampling

Patterned wafers can be inspected using the AE-1000, a semiautomatic microscopic system with a high-resolution autolaser focus that magnifies objects up to 1,000×.

Wafers can be processed with total or random sampling and classified as "accept," "reject," or "rework." Pieces in need of work are sent back to the sender cassette, thereby reducing handling that can damage the wafer further, and cutting back on the number of cassettes and elevators, according to the company.



Before passing under the microscope, the wafers are passed through a visual inspection station, where they are examined for gross defects under intense illumination. The wafer-inspection system, with a monitor and optics by Nikon and Ikegami, is available now for $86,650.

Aeronca Electronics Inc., 9625 Southern Pine Blvd., Charlotte, N.C. 28210. Phone (704) 523-4808 [Circle 342]

Combinational pc-board tester runs at rates of up to 30 MHz

Capable of running tests on complex boards at speeds 200 to 300 times faster than competitive systems, the System 750 in-circuit functional pc-board tester is the first combinational tester able to identify dynamic faults, according to the manufacturer.

Running at speeds as high as 30 MHz during performance testing, the system comes with two types of functional pins: TTL-CMOS pins, which operate at 30-MHz pattern rates, and precision programmable pins, which can operate at peak data rates of 20 MHz. The two types of pins can be combined up to a total of 256. An additional 256 10-MHz functional pins are also available. The System 750 incorporates the manufacturer's Flexpin in-circuit architecture, allowing flexible programming and simplified debugging procedures.

For analog testing, the system offers a range of instruments that can be automatically routed to any test-head pin by the signal-switching unit. The channels can be dedicated analog test channels or used in conjunction with digital channels to give true hybrid capability. The system uses Mediator test language for both in-circuit and functional testing. In addition, Capital, an automatic program generator, accesses a library of component descriptions and in-circuit test routines.

The System 750 is available now for $307,000. Delivery takes 90 days from receipt of order.

Factron/Schlumberger, 299 Old Niskayuna Rd., Latham, N.Y. 12110. Phone (518) 783-3600 [Circle 343]

Hybrid converter has 25-μs maximum rate

Developed for the manufacturer's new Vertically Integrated Product line, the hybrid HY-957A analog-to-digital converter offers a one-package solution to the data-conversion needs of high-performance data-acquisition systems. The hybrid houses a HI-574A ADC and an HA-5320 sample-and-hold amplifier.

The two-chip ADC features 150-ns microprocessor bus access time and a sampling rate of 45 kHz. The ADC section includes a +10-V reference, clock, three-state outputs, and a CMOS digital interface for microprocessor control.

The sample-and-hold circuit features an acquisition time of 1 μs (to within 0.01%) and includes an input transconductance amplifier capable of providing large amounts of charging current. It also includes a low-leakage analog switch and an output integrating amplifier. And, because it has an internal hold capacitor, an external one is not required. As an ADC subsystem, the HY-9574A features a maximum conversion time of 25 μs and offers standard unipolar and bipolar input ranges. The hybrid is laser trimmed for specified linearity, gain, and offset accuracy.

In lots of 100 pieces, the HY-9574A sells for $60.94. Volume production is set to begin next month.

Harris Corp., Melbourne, Fla. 32919.
Phone (305) 727-9100 [Circle 373]

ADC has display driver to capture measurements

An LCD drive gives the TSC815 3½-digit analog-to-digital converter the capability to become an inexpensive multifunction digital measurement system. When combined with an LCD display, the unit can measure ac and dc voltage, current, and resistance, and display its results.

Similar to the manufacturer's TSC805 model, the TSC815 has the additional display-hold mode. When active, conversions continue but the display is frozen until the user is free to observe and record the measurement.

The converter has 22 operating ranges, nine each for voltage and resistance and four for current measurement. Autoranging and manual scales from 200 Ω to 2 MΩ and voltage ranges from 200 mV to 2,000 V are available as options. Overrange detection is performed with a 4-kHz audio output signal, and an LED indicates if battery power is low. The typical 2,000-part resolution is extended to 3,000 parts when the user chooses manual operation. An on-chip two-digit memory is available for relative measurements.

The chip, which includes other warning signals and features, is housed in a 0.5-in.^{2} surface-mounting flat package and carries a $13.20 price tag. While samples are available immediately, production quantities require eight to 10 weeks for delivery.

Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, Calif. 94043.
Phone (415) 968-9241. [Circle 371]

Successive-approximation ADCs perform conversions in 50 ms

Differential inputs permit a pair of CMOS 10-bit successive-approximation analog-to-digital converters to reject common-mode signals, convert signals not referred to ground, and offset their analog input ranges.

The 20-pin ADC1005 outputs 10-bit data in a 2-byte format and is intended for use with 8-bit microprocessors. The 24-pin ADC1025 outputs 10 bits in parallel for 16-bit data buses or stand-alone applications. The reference voltage for both can be adjusted, allowing smaller voltage spans to be measured with 10-bit resolution.

The converters feature an easy interface to all microprocessors, the company says, and both operate from a single 5-V power supply. Conversion time for both is 50 ms.

The devices come in two versions. The BCJ-1 features nonlinearity of ±½ least significant bit, while the CCJ version features nonlinearity of ±1 LSB. Commercial versions and military versions are available for each model.

In plastic DIPs, commercial BCJ-1 versions of both the ADC1005 and the ADC1025 cost $10.95 in 100-unit original-equipment-manufacturer quantities. The CCJ-1 versions of both devices cost $15.95 in quantities of 100.

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, Calif. 95051
[Circle 372]

Converter card pumps out words at 40-MHz rate

The card-level CAV-1040 10-bit analog-to-digital converter delivers 40-MHz word rates, doubling the highest word rate previously available, its maker claims. The CAV-1040 accepts high-frequency analog inputs such as radar and video signals and generates 10-bit parallel data outputs compatible with emitter-coupled logic. The board includes a

ElectronicsWeek
July 15 issue

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ElectronicsWeek
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track-and-hold circuit along with encoding and timing circuits to minimize system design effort.

The CAV-1040 is suitable for such high-speed system applications as digital X ray and other medical uses, radar, TV-studio digitizing, digital communications, and real-time spectral analysis. The board is guaranteed monotonic over the temperature range from 0°C to +70°C, and total error at dc, including nonlinearity, is rated at 0.05% of full scale, ±½ least significant bit.

The board measures 5 by 7 in. and requires –5.2-, +5-, and ±15-V power supplies. Priced at $4,078, the CAV-1040 is available in 6 to 10 weeks after ordering.

Analog Devices Inc., Rte. 1 Industrial Park, P.O. Box 280, Norwood, Mass. 02062. Phone (617) 329-4700 [Circle 374]

Graphics work-station terminal offers up to 256 colors at once

The Vistagraphic 4500MV terminal converts Digital Equipment Corp.'s MicroVax 2 computer into a high-performance work-station host. The manufacturer's proprietary Vistagraf software performs most of the graphic manipulation and data management, leaving the MicroVax 2 to be fully dedicated to the application program and to host two Vistagraphic terminals with two monitors each.

Providing color graphics at 1,280-by-1,024-pixel resolution, the raster-graphics terminal features a 125-ns pixel speed and up to 256 simultaneous colors. The Vistagraf software, a subroutine-support package patterned after the Phigs graphics standards, increases terminal speed, the manufacturer says, while simplifying application development and reducing communications from the host. Vistagraf includes hierarchical structure support and structure-editing capabilities, local scale, translation and rotation of graphic images, and pixel plane partitioning.

With additional hardware and software, the Vistagraphic 4500MV can be linked with an Ethernet local-area network, allowing communication channel support between distributed computer graphic systems. The terminal software is also compatible with DEC's VMS operating system.

The basic terminal includes an MC68000 front-end processor, an AMD 2903 bit-slice graphics processor, 640-K bytes of memory (expandable to 2 megabytes), and a double-buffered pixel memory. An alphanumeric keyboard, serial interface (for connection to the MicroVax 2), self-diagnostics, Vistagraf software, and a 19-in. color monitor are also standard with the $31,695 terminal. Original-equipment-manufacturer pricing for the controller alone begins at $11,105.

Calcomp, 2411 W. La Palma Ave., Anaheim, Calif. 92801.
Phone (714) 821-2142 [Circle 344]

Popular PC-based design system is available in color

Color is now available to users of Futurenet Corp.'s Dash-3C computer-aided-design work stations. With the new system, the designer can assign a preferred color or use the system's predefined default colors to identify four separate classes of graphic display elements.

The four element groups include symbol-interconnection lines, symbols, symbol cell boundaries, alphanumeric fields, and command menu; drawing and menu cursors, command line, menu headings, area-definition lines, symbol-definition instructions, disk directory, and library directory; mode-status field value, message line, tagged objects, alphanumeric insert cursors, symbol-definition target lines, fast-pan windows, rubber-banded lines, and direct lines; and full-scale windows, display border, and principal status-field headings and values.

The complete Dash-3C system includes an IBM Personal Computer, PC/XT, or PC AT with a minimum of 256-K bytes of memory; an IBM enhanced color display and graphics adapter board with graphics-memory expansion card; keyboard; MS-DOS; mouse and parallel-port board with cable and modular plug; printer; and the Dash-3C software.

The complete system is priced from $10,880 to $14,380, depending on the computer desired. A Dash-3C upgrade package for existing monochrome versions, the model D3-MAP, is priced at $5,980.

Futurenet Corp., 9310 Topanga Canyon Blvd., Chatsworth, Calif. 91303. Phone (818) 700-0691 [Circle 345]

64-K static RAM merges design technologies for faster access

Bursting into the marketplace with a rapid 40-ns access time, the μPD4361 64-K-by-1-bit static RAM is, according to its maker, not only the first fully static 64-K-byte RAM but the fastest SRAM currently available.

The memory chip is built in a so-called mixed-MOS process. Memory cells are designed with a quartet of MOS transistors and two polysilicon resistors; the output drivers use three-state CMOS technology and are fully TTL-compatible.

The μPD4361 comes in two different packages and with four different speed ratings. In a 22-pin plastic DIP, the μPD4361C comes in 45-, 55-, and 70-ns versions that are priced, respectively, at $66, $54, and $46 each in lots of 100

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Electronic Packaging Designer

Involves mechanical design of electronic packages for military and commercial aerospace applications. Requires BS/MS ME and significant experience in the above areas including familiarity with electronic components, PCB design, chassis design and interconnect systems. Also requires knowledge of the effects of heat transfer, vibration and humidity.

Project Engineer

Take a project from inception to successful service use. Range of responsibilities include scheduling the program, coordinating with manufacturing suppliers and customers, preparing test plans, testing components, analysis of performance data, investigation of malfunctions or deviations from plan, and writing reports. Requires BSEE and significant project experience.

Mechanical Aircraft Engineers

Involves control dynamics, thermodynamics, aerodynamics and aeroacoustics for flight and environmental mechanical controls such as hydraulic and pneumatic.

- Instrumentation Engineer—for lab testing of both analog and digital equipment. Requires BSEE and appropriate experience.
- Design Engineers—responsible for analytical functions, requiring broad structural and dynamic expertise. Prefer advanced degree.

Systems Engineers/ Digital Control Applications

Total systems responsibility runs the gamut from concept formulation, interacting with customers, to detailed definition of hardware/software requirements and verification testing of final prototype systems. Requires BS/MS EE and specific experience in special purpose digital computers to implement complex control tasks in real time for gas turbine engines and avionic applications.

Software Engineers

Involves selection of processor; studies for hardware function, designs, and for hardware/software architecture; and programming microchips. Emphasis is on software design from the original concept stage through installation at customer facilities. Requires BS EE/Computer Science and 2-5 years experience in software engineering for control and diagnostic systems. Skill in Fortran, Ada, Pascal, Assembly languages and knowledge of gate array design are helpful.

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pieces. When packaged in a 22-pin ceramic leadless chip carrier, the SRAM features faster access times: 40, 45, and 55 ns.

The µPD4361K series each cost $93, $84, and $78, respectively, in quantities of 100 or more. All the parts are available immediately.

NEC Electronics Inc., 401 Ellis St., P.O. Box 7241, Mountain View, Calif. 94039. Phone (415) 960-6000 [Circle 362]

256-K n-MOS dynamic RAMs have built-in refresh mode

Organized as 64-K by 4 bits, the TMM41464P-12 and -15 256-K dynamic RAMs allow a four-to-one increase in data rate when used to store high-speed serial data strings, the manufacturer says.

The n-MOS device comes in two versions, a 120-ns model that burns an operating current of 65 mA, and a 150-ns chip that needs 55 mA of operating current. Both require a single 5-V power supply, and both use a maximum of 5 mA when on standby.

A refresh mode, called CAS before RAS (Column Address Strobe before Row Address Strobe) reduces systems' parts counts by eliminating the need for external refresh circuitry. In addition, because the chip has multiplexed address inputs, it can be packaged in an 18-pin plastic DIP for higher system density.

Compatible with logic families including Schottky TTL, the memory chips' delivery is quoted as stock to four weeks. The 120-ns part costs $17.20 each in 1,000-unit orders, while its 150-ns cousin costs $15.70 in the same quantity.

Toshiba America Inc., 2692 Dow Ave., Tustin, Calif. 92680.
Phone (714) 832-6300 [Circle 363]

Dense design, fewer features make 64-K EEPROMs cost less

Fabricated in metal nitride oxide semiconductor (MNOS) technology, a pair of 64-K EEPROMs offer design flexibility and low part cost. The devices are built with single-capacitor memory cells to reduce cell size and increase die density on the wafer, resulting in reduced consumer cost.

Under the theory that many customers often have to pay for memory chip features they do not need, the manufacturer has eliminated functions such as ready-busy to further lower the cost per part. The company says these features are uselessly repeated in systems where multiple memory devices are needed, and that the functions can often be controlled more efficiently by microprocessors.

Two versions are currently available: the 250-ns HN58064P-25 and the 300-ns HN58064P-30. Built into 28-pin plastic packages, they cost $18 and $16, respectively, when ordered in quantities in excess of 10,000 units.

Hitachi America Ltd., Semiconductor and IC Division, 2210 O'Toole Ave., San Jose, Calif. 95131.
Phone (408) 942-1500 [Circle 364]

Stacked dynamic RAMs create 128-K memory-dense device

Two 64-K-byte dynamic RAMs, stacked and permanently connected pin for pin, create a 128-K-by-1-bit DRAM for use in personal computer applications and in other systems that require high memory density.

Designated the model TMS41128B, the stacked DRAM offers a typical operating power of 193 mW and typical standby power dissipation of 32 mW. These characteristics suit it for systems that require low power dissipation. In addition, the memory is refreshed in 4 ms and has an access time of 150 ns.

The TMS41128B stacked dynamic RAM is available in a standard 16-pin plastic dual in-line stacked package. In quantities of 100 pieces, it is priced at $8. The part is available immediately.

Texas Instruments Inc., Semiconductor Group, Literature Response Center (SC-482), P.O. Box 809066, Dallas, Texas 75380. Phone (800) 232-3200 [Circle 361]

Microwave frequency counter takes readings up to 40 GHz

Thanks to the HP 5352A's use of a gallium arsenide sampler/down converter, the microwave-frequency counter makes measurements as high as 40 GHz with a 1-s resolution. The instrument derives its high-frequency performance from an expansion of the manufacturer's diode-sampling technology in GaAs. For testing low-frequency oscillators, a BNC-type input measures from 10 Hz to 525 MHz with resolution to 0.001 Hz.

The HP 5352A outputs more than 80 measurements/s over the HP-IB bus, which comes standard. The Sleep mode, which can power down the counter's internal operations when the instrument is not in use, creates an environment quiet enough for receiver testing.

Features available through the keyboard include Offset, which subtracts or adds successive measurements from or to a chosen or measured value; Smooth, which enhances readability when measuring noisy signals; Keyboard Lockout, which prevents loss of data due to an accidental change of measurement setup; and Display Lockout, which blanks the display concealing test results in a security-sensitive location.

With an average temperature rise inside the instrument of 2°C, the company says an 8-year mean time between failures is to be expected. While a temperature-compensated crystal oscillator is standard, two optional oven oscillators are available—a $750 model with a calibration interval of one year, and a $1,500 version with a five-year calibration schedule.

More than 30 diagnostic tests, accessible through the front panel or the HP-IB bus, have been built into the counter to identify faults to the board level. The basic HP 5352A 40-GHz microwave counter costs $10,000. Delivery is six weeks after receipt of order.

Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto., Calif. 94303 [Circle 381]

Wafer-handling system boasts 50-frame input hopper

Wafers travel from input cassette to output cassette without being touched by human operators in the model 380 wafer-handling system. The unit features a 50-frame input hopper, dual 25-wafer input cassettes for wafers with diameters from 3 to 6 in., and dual 25-frame output cassettes. Pattern recognition is standard on the model 380, automatically correcting for mask-pattern rotation or offset, according to the manufacturer.

An RS-232-C port and an optional peripheral communications controller module allow the model 380 to communicate with other pieces of equipment, such as the manufacturer's automatic wire bonder, an automated wafer-dicing system, and a die bonder. In addition, wafer batches can be tracked by an optional bar-code or optical-character reader.

Operator control is accomplished through menu prompts given on a closed-circuit TV monitor with built-in keyboard, and diagnostics are built into the system. Using the monitor and the communications options, one operator can monitor multiple 380 systems, the manufacturer says.

The price and delivery date for a model 380 wafer-handling system depend on the customer's requirements.

Kulicke and Soffa Industries Inc., 507 Prudential Rd., Horsham, Pa. 19044.
Phone (215) 674-2800 [Circle 365]

Mobile clean room can be installed in a day

A completely self-contained mobile clean room is available in several interior dimensions: widths from 4 to 8 ft, lengths from 6 to 14 ft, and heights from 8 to 10 ft. As a preassembled unit, it is mobile and can be installed in a day by simply connecting water, electricity and drain, and clamping the HEPA filters in place.

Also delivered knocked down for on-site assembly, the clean room is available as a Class 10 or Class 100 environment. The clean room is made up of four basic components: the air-conditioning unit, which is completely assembled with all equipment needed to control cleanliness, temperature, humidity, and pressurization; the welded steel base assembly, designed to form a tub-like return-air subfloor with integral raised floor; the modular nonload-bearing walls consisting of steel-clad baked-enamel insulated panels joined by gasketed extruded-aluminum connectors; and the ceiling assembly, a prefabricated steel plenum containing lights, HEPA filters, and acrylic light diffusers.

By adding slave modules, floor space can be tripled without additional air-conditioning equipment. A typical system is priced between $30,000 and $40,000, depending upon the customer's needs, and takes between 10 and 14 weeks to be delivered.

Clean Room Technology Inc., 4003 Eastbourne Dr., Syracuse, N.Y. 13206.
Phone (315) 437-2152 [Circle 366]

Op amp meets military specs for high-accuracy applications

Screening procedures for the PA07M high-current power operational amplifier are in full compliance with the new revision C of MIL-STD-883 requirements, the manufacturer claims. The parts are completely tested to all minimum and maximum parameters at −55°C and +125°C rather than simply testing offsets at a particular temperature.

Designed for high-accuracy applications requiring up to 5 A drive to resistive, capacitive, or inductive loads, the op amp's class A-B output stage holds distortion below 0.1% while driving an 8-Ω load to 60 W at 3 kHz. A FET input stage lets the amps be controlled by low-level signals such as photosensors.

The amp features a thermal shutdown circuit and internal compensation for use at all gain settings. The hybrid circuits use thick-film conductors, ceramic

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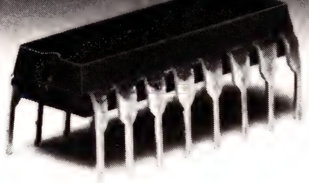

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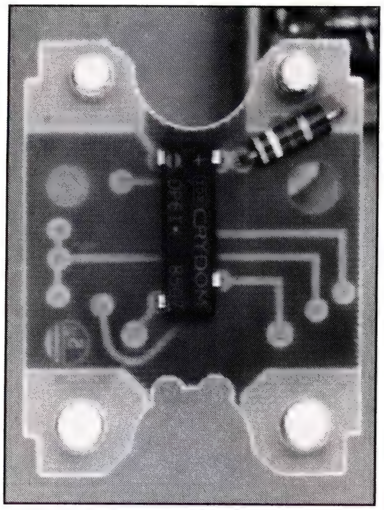
Circle 55 on reader service card

capacitors, and silicon semiconductors to maximize reliability. The 8-pin TO-3 package is hermetically sealed and isolated. In lots of 100 pieces, the PA07M is priced at $120 each. Delivery takes 14 to 16 weeks.

Apex Microtechnology Corp., 1130 E. Pennsylvania St., Tucson, Ariz. 85714. Phone (602) 624-0273 [Circle 368]

High-current relays are built around Chipswitch

Based on its Chipswitch, Crydom's solid-state relays operate in 10-, 25-, and 40-A capacities at 240 V. The firm says the Series 1 CSD models are better than existing dc-controlled, premium-line, solid-state power relays with inverse parallel silicon-controlled-rectifier output devices.



Although lower input impedance (390 Ω) reduces the relays' sensitivity, they can operate directly from TTL signals. Improved zero-voltage turn-on features complement the devices' inherent turn-off characteristics, further reducing electromagnetic interference. A 12-to-280-V ac operating range optimizes performance at both 120- and 240-V ac line voltages.

Capable of withstanding changes in voltage over time of up to 200 V/ps, the relay can switch loads that have power factors of 0.5 to 1.0 without a snubber. The resulting off-state leakage is less than 1 mA in all models; one is available with a maximum of 100 μA leakage. Available next month, the relays—in lots of 1,000—are priced 20% to 30% below typical solid-state relays.

Crydom, 1521 Grand Ave., El Segundo, Calif. 90246.
Phone (213) 322-4987 [Circle 367]

500-V MOS FETs require no protection circuitry

With their fast-recovery internal inverse diodes, Siemens' 400- and 500-V MOS FETs can be used without inverse-diode protection circuitry. Known as Fredfets (for Fast Recovery Epitaxial Diode FET), the models BUZ 201, 210, 382, and 385 come in TO-3 and the new TO-218 packages.

When trying to use a vertical power MOS FET's internal diode to pass freewheeling current, designers usually encounter potentially destructive change in voltage with respect to time ratios (dv/dt). They have had to use elaborate protective circuitry that redirected this current into other external components to ensure integrity for applications that called for more than 200 V.

With Fredfet's internal diode, there is such a short reverse recovery time that the diode prevents the device from having dv/dt problems at high voltages. The parts have on-resistance ratings (at junction temperatures of 25°C) of from 40 to 80 Ω, the same as conventional MOS FETs, Siemens says.

Priced from $10.25 to $15.92 depending on voltage rating and packaging, the MOS FETs are available now for immediate delivery.

Siemens Components Inc., Colorado Components Division, 800 Hoyt St., Broomfield, Colo. 80020.
Phone (800) 338-2777 [Circle 369]

IC combines four line drivers, yet chip draws just ½ mA

A low-power RS-232-C line-driver chip that draws only ½ mA of supply current can be shut down to decrease the supply current to 0. The LT 1032, which combines four line drivers on one chip, is suitable in any application where a low-power device is needed to communicate digital data with either the RS-232-C or RS-423 communications interface standard.

The LT 1032's chip design allows it to operate at a lower power-supply voltage than most other line drivers, the manufacturer says. While the LT 1032, like other line drivers, can operate at ±12 to ±15 V, it meets RS-232-C specifications with only ±6 V and operates most industry-standard receivers properly at ±5 V. This eliminates the need for a separate line-driver power supply in many cases.

Unlike other line drivers, the LT 1032 is internally protected against overloads, short circuits, and up to 30 V of externally applied voltage. Available now, the LT 1032 is priced at $2.95 each in lots of 100 pieces.

Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, Calif. 95035. Phone (408) 942-0810 [Circle 370]

Removable Winchester cartridge takes 8 megabytes from disk

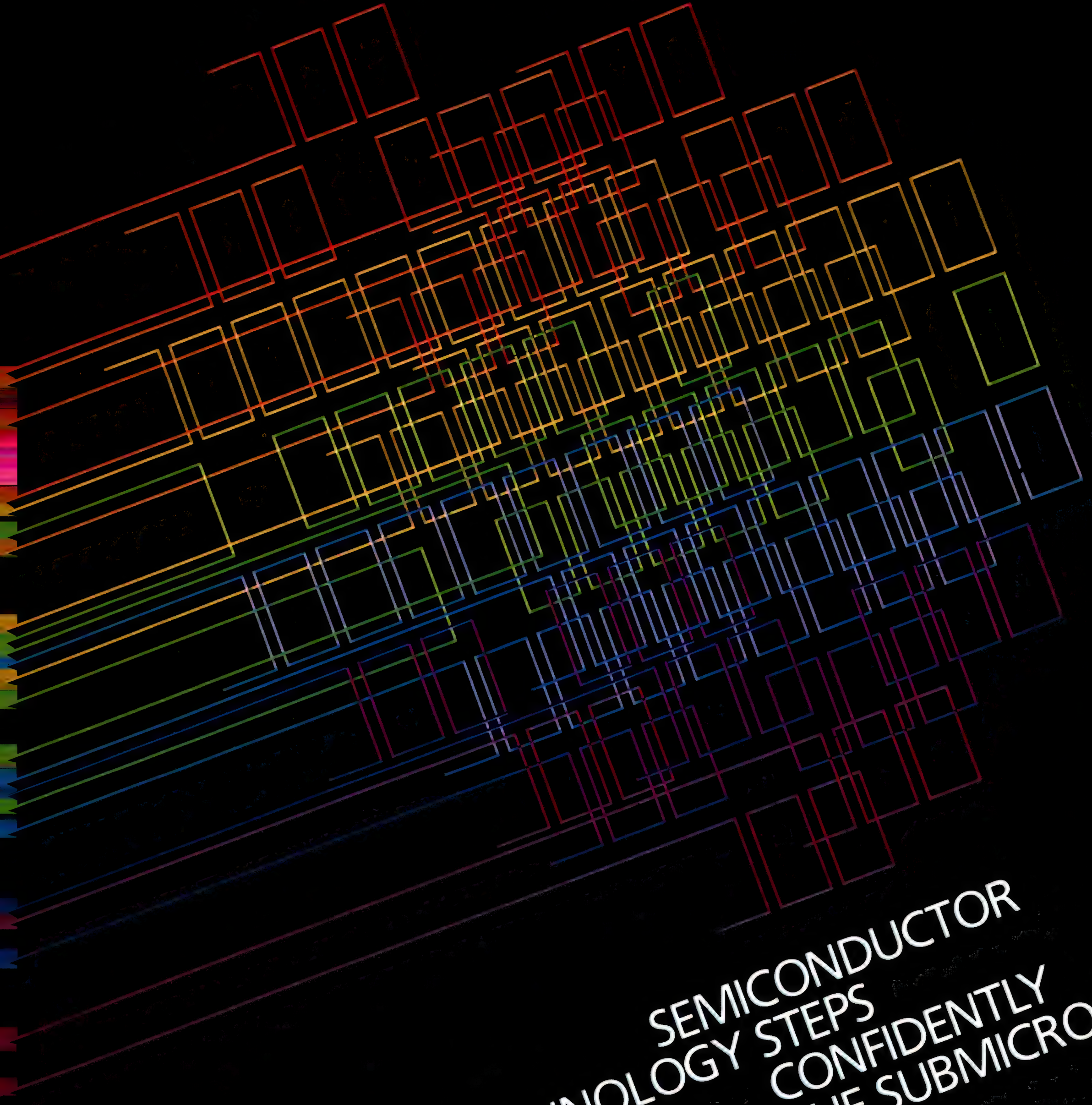
Storage and backup requirements for the iRMX-86 real-time operating system are addressed by this family of 8-megabyte 5¼-in. removable Winchester cartridge systems. Rather than backing up a typical 10-megabyte disk onto 30 floppy disks, the user of a Datasafe 8R subsystem can copy 8 megabytes from the fixed disk to the removable cartridge in 90 s—a data-transfer rate of 5 Mb/s.

Datasafe 8R Winchester cartridge systems include up to two fixed or removable Winchester drives, a formatter card, a Multibus host adapter card with 16-bit I/O, all necessary cables and connectors, plus the iRMX-86 software driver and a bootstrap loader that enables booting the system from the Winchester.

Datasafe 8R subsystems are compatible with all Multibus systems running under iRMX-86 V5.0, V6.0, or later releases, including Intel Corp.'s 300 family of computers. The 8R subsystems can be installed by running the iRMX-86 interactive configuration utility.

Prices of the Datasafe 8R subsystems start at $8,995, and quantity discounts are available. Delivery takes two weeks.

Winchester Systems Inc., 400 W. Cummings Park, Woburn, Mass. 01801. Phone (800) 325-3700 or in Massachusetts, (617) 933-8500 [Circle 359]



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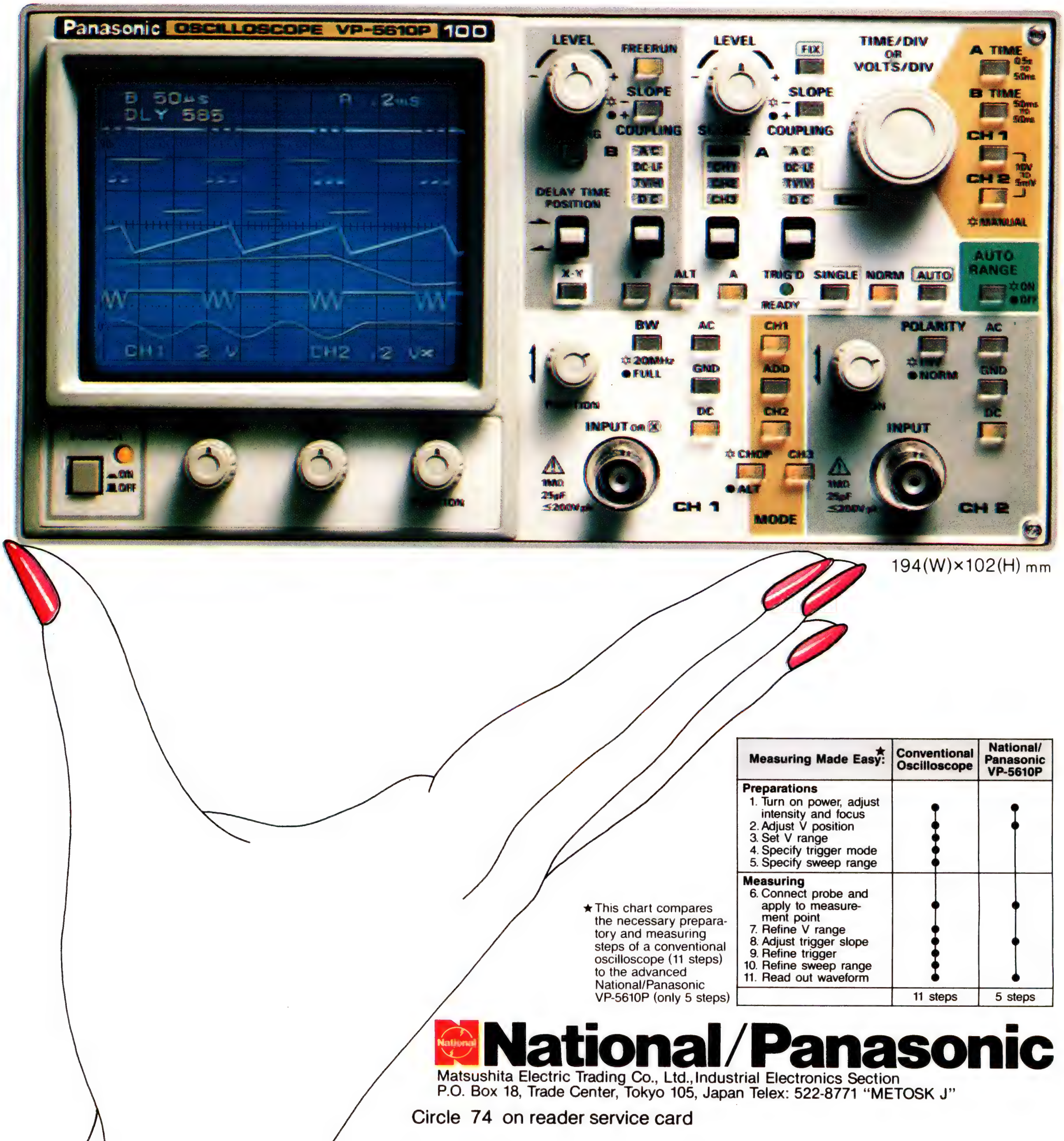


194(W)×102(H) mm

Measuring Made Easy:★	Conventional Oscilloscope	National/Panasonic VP-5610P
Preparations		
1. Turn on power, adjust intensity and focus	●	●
2. Adjust V position	●	●
3. Set V range	●	
4. Specify trigger mode	●	
5. Specify sweep range	●	
Measuring		
6. Connect probe and apply to measurement point	●	●
7. Refine V range	●	
8. Adjust trigger slope	●	●
9. Refine trigger	●	
10. Refine sweep range	●	
11. Read out waveform	●	●
	11 steps	5 steps

★This chart compares the necessary preparatory and measuring steps of a conventional oscilloscope (11 steps) to the advanced National/Panasonic VP-5610P (only 5 steps)

National/Panasonic

Matsushita Electric Trading Co., Ltd., Industrial Electronics Section
P.O. Box 18, Trade Center, Tokyo 105, Japan Telex: 522-8771 "METOSK J"

Circle 74 on reader service card

Keyboard incorporates touch pad for easy access

For computer operators who would like to be able to use their touch pads without moving their hands from the keyboard, the model KB5153 keyboard incorporates the touch pad immediately to the right of the cursor-number pad. The KB5153 is compatible with the keyboards of the IBM Corp. Personal Computer or the PC AT, the manufacturer says, and custom keyboards integrating the touch pad can be designed for original-equipment manufacturers. The touch pad also is available in a stand-alone configuration, in which case it can become an upgrade to an existing system.

The touch pad runs in four modes: cursor-key, mouse, absolute-coordinate (graphic), and function-key. In this last mode, the touch pad can support up to 36 operator-defined function areas by means of a visual overlay. Combinations of these modes are possible, providing pointing and function-key operation simultaneously.

The retail price of the model KB5153 keyboard with touch pad is $399.95, and dealer shipments will be made by July 15.

Key Tronic, P.O. Box 14687, Spokane, Wash. 99214. Phone (800) 262-6006, or in Washington state, (509) 928-8000 [Circle 357]

Smart buffer-spooler routes data to HP peripherals

Plotters and printers can be driven simultaneously by Expressway, a buffer-spooler that incorporates a microprocessor and up to 1 megabyte of memory. Expressway is designed for Hewlett-Packard Co. desktop computers as well as printers, plotters, and other peripherals running on the IEEE-488 bus.

It differs from RS-232-C spoolers, the manufacturer says, in that it can route data coming in on a single set of lines to different peripherals running at different rates, automatically and simultaneously. Further, by using its intelligence, Expressway can interrogate a plotter and send setup information to the computer if required.

Typical configuration prices for Expressway are $1,395 for the 256-K-byte three-port version and $2,495 for the 1-megabyte three-port version. Shipments will begin in mid-June.

Eventide Inc., 1 Alsan Way, Little Ferry, N.J. 07643.
Phone (201) 641-1200 [Circle 360]

Desktop tape drive provides 138 megabytes of backup

Weighing only 36 lb and taking up a desktop area of 14 by 19 in., the PCT-1000-T nine-track tape drive provides backup capacity of up to 138 megabytes and uses standard 7-, 8½-, or 10½-in. tape reels. The enclosing cabinet is 5½ in. high. With the addition of an optional interface, the tape drive can be made compatible with the IBM Corp. Personal Computer.

The tape drive is compatible with the Cipher/Pertec interface and supports a variety of recording formats including the 800-b/in. formats of nonreturn to zero inverted, IBM, and the American National Standards Institute; the 1,600-characters/in. phase-encoded, IBM, and ANSI formats; and dual-density recording of 3,200 or 1,600 c/in. Available now, the drive retails for $3,557.

Ibex Computer Corp., 20741 Marilla St., Chatsworth, Calif. 91311.
Phone (818) 709-8100 [Circle 358]

With adapter, IBM PC/XT analyzes and edits speech

With the addition of the OM8010 speech adapter box, IBM Corp. Personal Computers gain speech-analysis and -editing capabilities. The box was originally available only with Hewlett-Packard Co. personal computers; software for the adapter set has been modified so that it now runs on the IBM PC.

An IBM PC/XT with a display and 256-K bytes of RAM can be merged with the adapter by adding three boards: a graphics display card, a memory card, and an IEEE-488 bus converter. With the system, which samples analog speech input from audio tape and displays the parameters on the screen, users can select the sections they want to edit with begin and end markers. When editing is complete, parameters are converted into code and stored on EPROM or disk.

Software is arranged into eight interactive modes. The user can pronounce single speech frames or segments and check them for quality. Each mode has a menu of commands, and all except the destroy function are single-stroke commands; data-destroy commands require confirmation to protect against accidental data loss. Available now, the system costs about $5,000.

Signetics Corp., 811 E. Arques Ave. Sunnyvale, Calif. 94086.
Phone (408) 991-2000 [Circle 382]

Data-encryption system boasts 10^{81} primary keys

A three-level key system preserves code secrecy for the DSD 72C data-encryption unit. Designed to protect synchronous digital transmissions, such as those for terminals, computers, aircraft data communications, and digital speech systems, the full-duplex unit operates at standard data rates up to 2 Mb/s; data rates up to 8 Mb/s are available on special order, according to the manufacturer.

Encrypted data received by any terminal device equipped with a code-compatible DSD 72C is deciphered in plain text. If the message is intercepted by a terminal not equipped with the encryption device, a stream of unintelligible symbols will appear, rendering interpretation almost impossible, the company says. The unit's code depth of over 100 years is ensured by its 10^{81} primary keys and 2.5×10^{17} secondary keys. A variety of standard interfaces is available. Priced at $3,825, the DSD 72C is available 30 days after receipt of order.

Technical Communications Corp., 100 Domino Dr., Concord, Mass. 01742. Phone (617) 862-6035 [Circle 351]

Lone work station can control entire communications network

From a single console, an entire data-communications network can be controlled, according to the manufacturer of the Analysis Workstation. The unit combines connectivity and network diagnostics in a single work station. The machine provides interactive access to network software from a high-resolution ergonomic terminal.

Host applications including Network Communications Control Facility and Network Problem Determination Application can be used, and modem and line impairment can be displayed in either full or split-screen fashion. The work station can monitor more than 6,000 devices.

Based on the manufacturer's PDX Messenger graphics system and coupled with unique windowing software, the work station can monitor up to four network operations, which can be continuously updated. Test and monitoring results are displayed in simple color or monochrome formats. An optional feature provides a touch-sensitive screen.

Available in the fall, the price for the work station will be about $6,000. Options are priced separately.

Paradyne Corp., P.O. Box 1347, 8550 Ulmerton Rd., Key Largo, Fla. 33540. Phone (813) 530-2000 [Circle 352]

Multibus RAM card has 2 megabytes on board

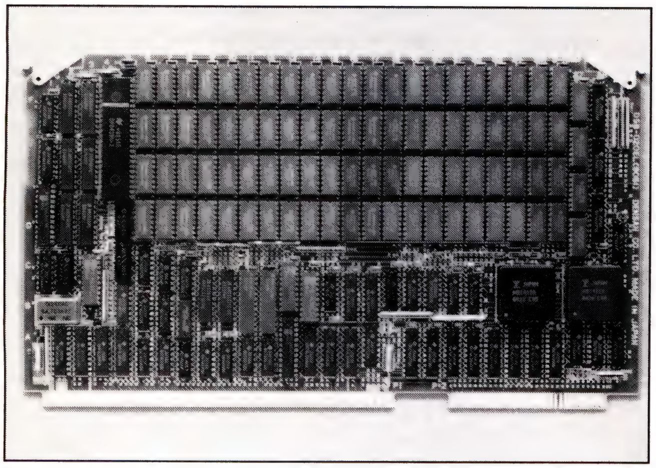
Complete with an error-correction and -detection unit, the DSB-020EL Multibus RAM board is designed to operate with all iLBX-compatible Multibus CPU boards and systems. The iLBX, a high-speed memory bus from Intel Corp., is an enhancement for Multibus systems, providing faster memory access than is possible with the Multibus alone.

This memory board offers users of CPU boards compatible with the iLBX enhancement 1 or 2 megabytes of dynamic RAM on a single board. Each board holds either 44 or 88 150-ns, 256-K dynamic RAMs, a large-scale integration RAM controller, a LSI error-detection and -correction unit, and the dual Multibus and iLBX interface. Memory refresh and error-change and -correction operations are performed on board, transparent to the CPU. Maximum access time is 330 ns, and maximum cycle time is 360 ns.

The error change and correction system detects and corrects all single-bit errors; double-bit errors, however, are detected but not corrected. The logging and communication of errors to the CPU is handled through a 16-bit error-status register, which the CPU accesses through a Multibus I/O port. The unit supports 24 address bits, for a direct-address memory of up to 16 megabytes. Moreover, since the iLBX bus will support up to 4 memory boards, a Multibus system can be configured with up to 8 megabytes of iLBX memory.

The 2-megabyte version, in quantities of 100, sells for $1,796 each. The 1-megabyte version sells for $1,084 in the same quantities.

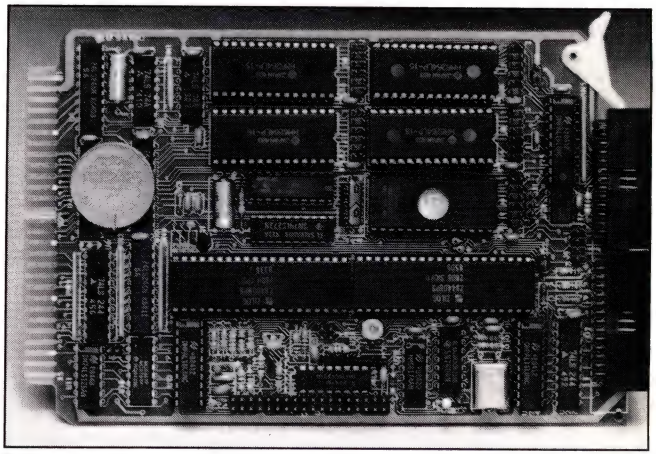
Pascot Inc., Densan Division, 17981 Skypark Circle, Suite B, Irvine, Calif. 92714. Phone (714) 261-5220 [Circle 347]



STD-bus computer board comes configured for multiprocessing

The CPU-9, a single-board computer based on the 6-MHz Z80 microprocessor, provides high-speed multiprocessing for the STD-bus.

With 64-K of static RAM and 32-K of EPROM, the board has a battery-backed, real-time clock and calendar, two programmable serial ports, and a parallel port. An Intel Corp. piggyback SBX connector is included, as is a pair of 16-bit counter/timer channels with interrupts. Especially useful in distributed-control applications where several CPUs work in parallel, sharing common data, the CPU-9 conforms to all Z80 STD specifications, the manufacturer says. With the board, other STD-bus boards can be used in the same system.



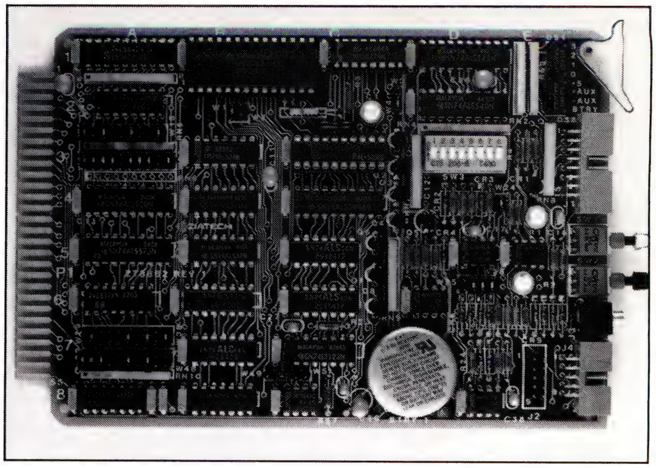
Delivery is stock to 30 days for the CPU-9, which is priced from $250.

Computer Dynamics Inc., 105 S. Main St., Greer, S.C. 29651. Phone (803) 877-7471 [Circle 348]

Peripheral board protects against STD-bus system failure

The ZT 8882 System Integrity Board easily handles real-time utility functions, such as ac- and dc-power failure detection, timing problems, and hardware and software failures, its manufacturer says.

An STD-bus board, the ZT 8882 will sense the loss of an ac cycle and immediately signal the CPU to shut down the system. If the 5-V dc power drops below 4.7 V, a battery backup switches on to protect the board's memory (from 2-K to 8-K bytes). A "watchdog" timer performs interrupts and can be programmed to activate an external alarm if the host CPU



does not reset it at user-established intervals. If necessary, a second computer can monitor the timer, taking over control of the process if the system fails. A real-time clock/calendar that provides the date and time of day is also on board. The clock can also be used to provide paced interrupts.

The system includes eight input switches for setting up system parameters, or they can be used together as an 8-bit digital input port. Available now, the ZT 8882 is priced at $398 in single-unit quantities.

Ziatech Corp., 3433 Roberto Ct., San Luis Obispo, Calif. 93401.
Phone (805) 541-0488 [Circle 349]

Interface board for VMEbus has six independent channels

The PME SIO-1 multiprotocol serial-interface board provides six independent serial I/O channels to the VMEbus. Each channel uses the 68561 Multi-Protocol Communications Controller, so the user can select from a range of options for speed, protocol, and encoding.

All six channels offer a freely selectable interface for either RS-232C or RS-422 ports. Asynchronous, bisynchronous, or synchronous operation using character or bit-oriented protocols such as IBM bisynchronous and X.25 are also featured, and are programmable between 110- and 38,400 bits/s. Parity check and cyclic redundancy checking are available.

The communications controllers buffer up to eight received and transmitted characters, and can transfer data in 16-bit words across the VMEbus to optimize bus throughput. The board, which occupies 512 bytes in the 16-megabyte address map, uses a user-selectable address modifier code.

The movement of data and command/status information between the system bus and each communications controller is controlled by a trio of maskable auto-vectored interrupts. An eight-character first-in/first-out memory buffer in each communication controller holds data during transmission and reception.

A switch on the card's front panel has an LED indicator and can be used to isolate the board from the bus during debug and maintenance. Other features include 22 directly addressable registers that control data transfers and status reporting modes for full or half duplex and local loop-back, error-checking, and a wire-wrap area so that users can assign drivers and receivers to each channel.

Available from stock, the board costs $985 in single quantities; orders of 10 to 24 reduce the unit price to $926, and larger-quantity original-equipment-manufacturer discounts are available on request.

Plessey Microsystems Inc., 1 Blue Hill Plaza, Pearl River, N.Y. 10965. Phone (914) 735-4661 [Circle 350]

Software package for OEMs links micros to mainframes

Software, documentation, and technical assistance make up the Micro/Answer Toolkit, a package that other software developers can add to their own products to create a micro-to-mainframe link. When used in conjunction with the company's previously released Answer/DB, a mainframe engine, Micro/Answer allows access to nearly any IBM Corp. mainframe file or data base including IMS, DL/1, VSAM, IDMS, Total, and Adabase. It first extracts user-selected data from any data base on the mainframe, then delivers it to the personal computer in a file formatted for use on that computer.

A modifiable product for original-equipment manufacturers, Micro/Answer offers open-ended architecture that can access a number of different data bases rather than just one proprietary data base. Security controls are maintained at the database, segment, record, field, and field-content levels, and user profiles determine who can access what information. Answer/DB is priced at $30,000 for the DOS version, $45,000 for the OS version.

Informatics General Corp., 21031 Ventura Blvd., Woodland Hills, Calif. 91364. Phone (213) 887-9040 [Circle 353]

Software simulates CMOS ICs on Mentor's work stations

MOS and CMOS device circuits can be simulated with MSimon, software for the Mentor Graphics Corp.'s Idea series of computer-aided engineering work stations. MSimon is based on the Simon Simulator, an iterative algorithm developed in 1982 for commercial-IC design.

MSimon achieves 100% convergence—the ability of the simulator to find a stable solution—on the first run, the manufacturer says. The program is claimed to run from 5 to 30 times faster than Spice on the Idea work stations, and its efficient use of computer memory allows the simulation of more than 40,000 transistor circuits. These capabilities—speed of convergence and memory capacity—suit MSimon for complex circuitry such as memory cells, Mentor claims.

MSimon is available with MSpice simulation software at a cost of $23,800, or as an upgrade to MSpice for $13,900.

Mentor Graphics Corp., 8500 S.W. Creekside Pl., Beaverton, Ore. 97005. Phone (503) 626-7000 [Circle 356]

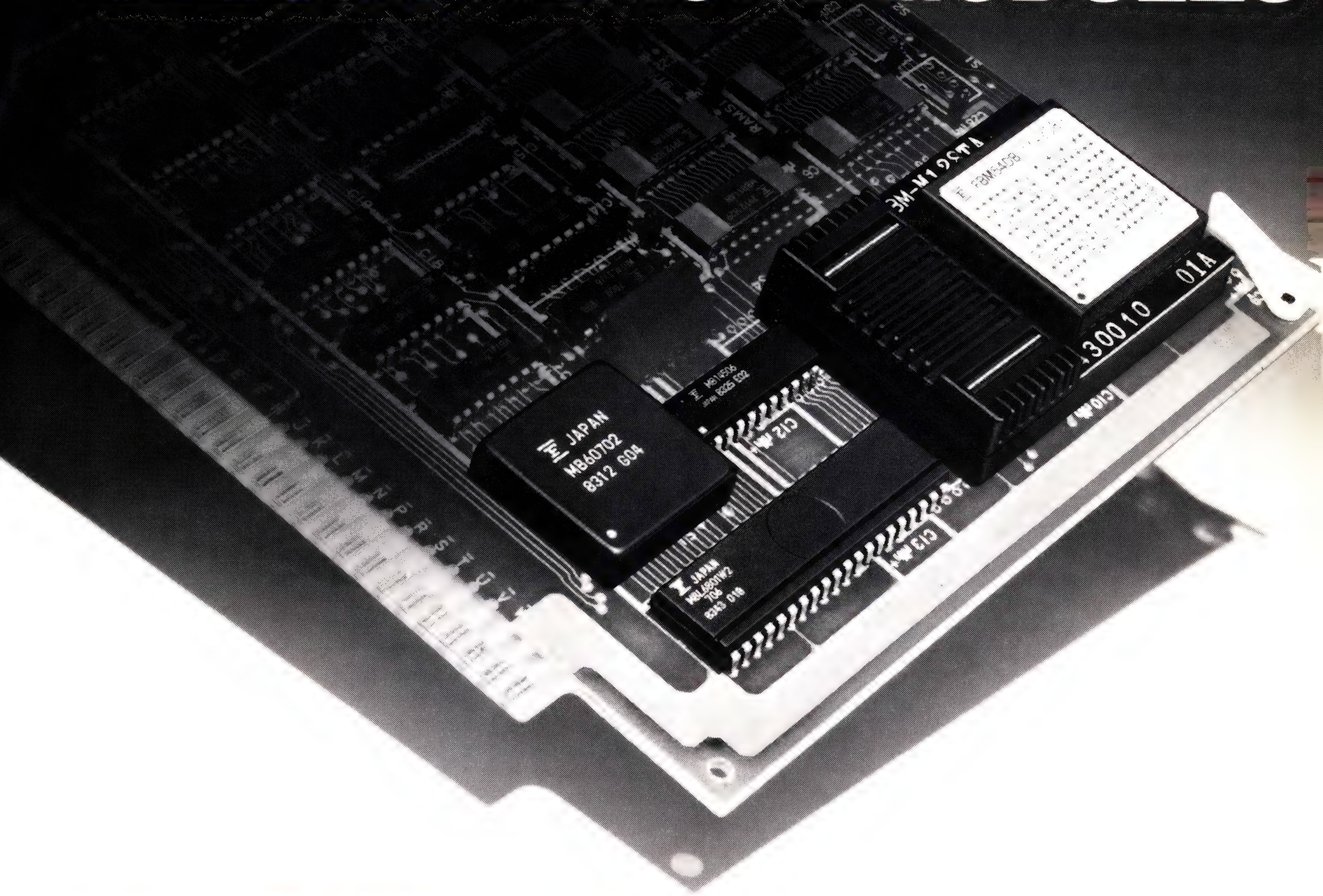
Tricon 1 controllers speak T-Cal programming language

Users of Tricon 1 fault-tolerant controllers in factory automation and process industries can enrich their programming environment with TriStation, an application programming environment that includes software and an IBM Corp.-compatible personal computer. Although TriStation presents a high-level, interpretive interface to the user, the resulting code executes at compiled speeds, the manufacturer says.

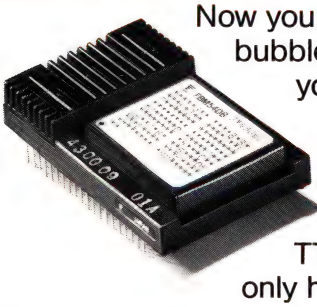
TriStation's high-level programming language, T-Cal (Triconix Control Application Language), uses a form of relay ladder logic, a popular language for industrial-automation applications. With T-Cal, programmers can partition their programs into segments that can be individually debugged, stored, recalled, and reused each time a function is duplicated. The programmer uses five software elements: a ladder editor, a board/point editor, a data dictionary, a full-function logic simulator, and an interactive debugger. Including software, disk, and microcomputer—TriStation is priced under $6,000.

Triconex Corp., 16800 Aston St., Irvine, Calif. 92714.
Phone (714) 261-0880 [Circle 377]

TTL LEVEL BUBBLE MEMORY MODULES



Fujitsu's BMM Series bubble memory modules let you design your own board.



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- Maintenance-free design

Specifications

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Memory capacity	1,048,576 bits (128K bytes)	
Interface	TTL level	
Transfer rate	100K bit/s	
Access time	11.2ms	
Operating temp.	0 to 65°C	5 to 50°C
Storage temp.	−40 to 85°C	−30 to 75°C
Weight	75g	
Dimensions	43.5 x 65.5 x 13.7mm	

Fujitsu Component Europe, B.V.:
Rijnkade 19B, 1382 GS, Weesp, The Netherlands Phone: 02940-18748 Telex: 11966 FUJCE NL
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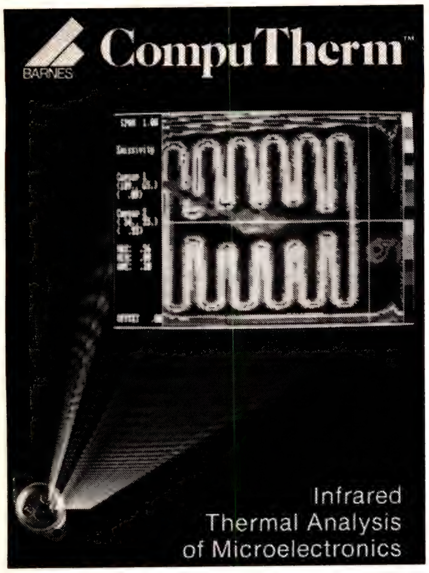


The heat's on. A six-page color pamphlet from Barnes Engineering Co. describes Computherm, a system consisting of an RM50 microimager, a precision-heated substage, modified computer with color display, hard-copy printer, and software. Computherm performs noncontact thermal measurement of powered-up microcircuits, from die-attach problems to latchup, with automatic correction for spatial emissivity; 13 four-color examples of on-screen analysis images are shown in this pamphlet. Request a free copy by calling (203) 348-5381 or write to the company at 44 Commerce Rd., Stamford, Conn. 06904. [Circle reader service number 421]

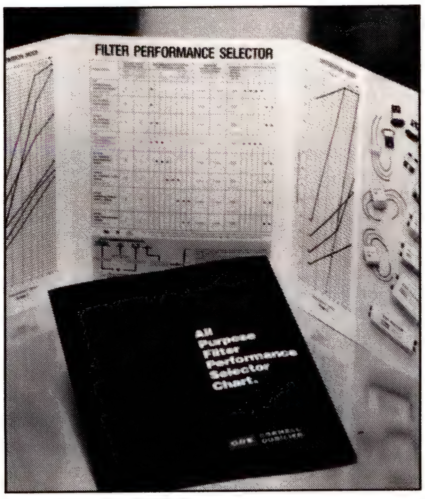
Roving reporter. A BT-Basic program that returns statistical reports on pc boards under test and repair, Q-Stats runs on the Hewlett-Packard Co. 3065 test system. Described in HP Product Note 3065-1, it is offered free to engineering and production managers, test programmers, and others who prefer to control manufacturing and test processes, rather than to accept and live with the problems. Copies of the product note can be obtained by writing to Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto, Calif., 94303. [Circle 422]

Ad valorem. "Value Added Testing" is the title of this pamphlet from Westinghouse Electric Corp. describing that manufacturer's test procedures for power semiconductors. The procedures include testing by ac blocking life for electrical characteristics at rated voltage and rated junction temperature. Three groups of Mil-Spec testing capabilities are also listed. For a copy, phone (412) 925-7272 or write to Westinghouse, Semiconductor Division, Youngwood, Pa. 15697. [Circle 423]

Masked marvel. The Applied Lithography Operation—formerly Qualitron, a commercial photomask supplier—of Perkin-Elmer Corp. and its work in photomask technology are presented in a 12-page illustrated brochure containing sections on electron-beam and optical lithography, computer-aided-design services, and quality assurance. Performance characteristics and specification data sheets are included in a pocket on the back page of the brochure, and a flow chart contrasts electron-beam versus optical production procedure. For a free copy, call or write the Perkin-Elmer Corp., 50 Danbury Rd., Wilton, Conn. 06897. Phone (203) 834-6330. [Circle 424]

Save those bits! The sensitivity of 256-K dynamic RAMs to decoupling-induced soft errors—random loss of one or more bits of memory—is discussed in an eight-page technical paper from AVX Corp., a manufacturer of multilayer ceramic capacitors. The high-frequency decoupling performance of capacitors was studied under actual operating conditions on the manufacturer's own memory boards. For a free copy of this paper, request "Decoupling: 256-K DRAMs" from AVX Corp., P.O. Box 867, Myrtle Beach, S.C. 29577, or call (803) 448-9411. [Circle 425]

Runs interference. This "All-Purpose EMI Filter Performance Selector Chart" from Cornell Dubilier guides engineers through a step-by-step process in which they first select the applicable electromagnetic-interference emission limit required; then select the type of filter that meets operating-current requirements; and finally identify the available mechanical configurations that satisfy the installation requirements. The selector chart comes free on writing to the company at Wayne Interchange Plaza 1, Wayne, N.J. 07470, or call (201) 299-8000. [Circle 426]


FILTER PERFORMANCE SELECTOR
All Purpose Filter Performance Selector Chart.
CDE CORNELL DUBILIER

Relay race. Two market and applications reports, the sixth and seventh in a series from Electronic Instrument & Specialty Corp., discuss applications using the company's reed relays. The instrumentation and application report examines reed relays having high voltage isolation, low capacitance shielding, and low charge-high insulation; the telecommunications market and applications report discusses loop detection and current-monitoring circuits. Both reports are illustrated with circuit diagrams. Copies are available at no charge; call the company at (617) 438-5300, or write to 42 Pleasant St., Stoneham, Mass. 02180. [Circle 427]

Flowers and music. A 256-page catalog offers nearly 400 products in 56 categories of template software for Lotus 1-2-3 and Symphony. Some of the categories covered are business software, utilities, training aids, books, and accessories. The publisher, 4-5-6-World, also maintains and continually updates a data base of Lotus products. To receive a free copy of the catalog or to learn more about the data-base service, call (800) 524-5678 toll-free; in California (805) 564-2424. The mailing address is Dept. P-102, P.O. Box 22657, Santa Barbara, Calif. 93121. [Circle 428]

School bells. The National Action Council for Minorities in Engineering directs this handbook, titled *Improving the Retention and Graduation of Minorities in Engineering*, to educators and executives working to improve the success rate of blacks, Hispanics, and American Indians in the engineering professions. Detailed operating procedures of a model minority engineering program (MEP) are presented, as well as a checklist for evaluating an MEP center based on a decade of nationwide development of MEPs. Available for $10, the handbook can be ordered by writing to Nacme Inc., 3 W. 35th St., New York, N.Y. 10001 or calling the organization at (212) 279-2626. [Circle 430]

Favorable position. A line of linear and rotary tables, optical mounts, helium neon lasers, and more is presented in "Positioning Systems—Lasers and Accessories," a 98-page catalog from Aerotech. Included are descriptions, photos, price, and other data for both components and complete systems—for example, helium neon laser tubes from 0.5 to 16 mW; Unidex motion controllers; and servo amplifiers and dc servo motors. Copies are available on request from Aerotech Inc., 101 Zeta Dr., Pittsburgh, Pa. 15238. Phone (412) 963-7470 [Circle 429]

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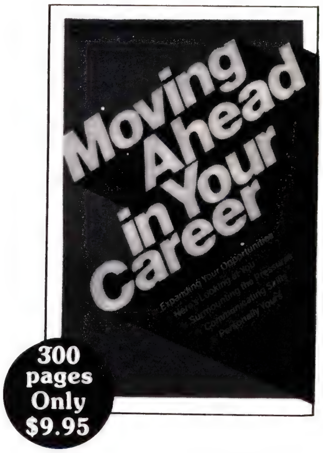
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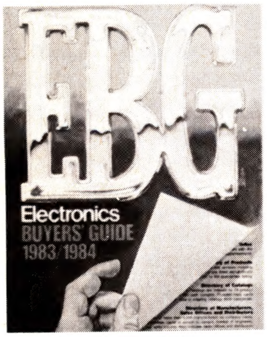

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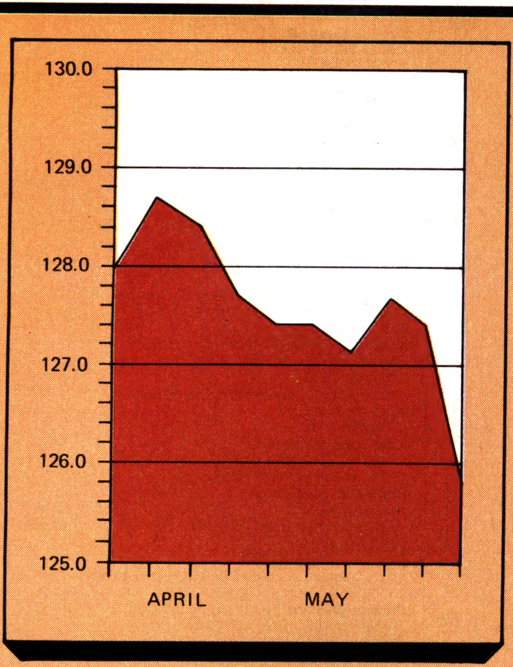

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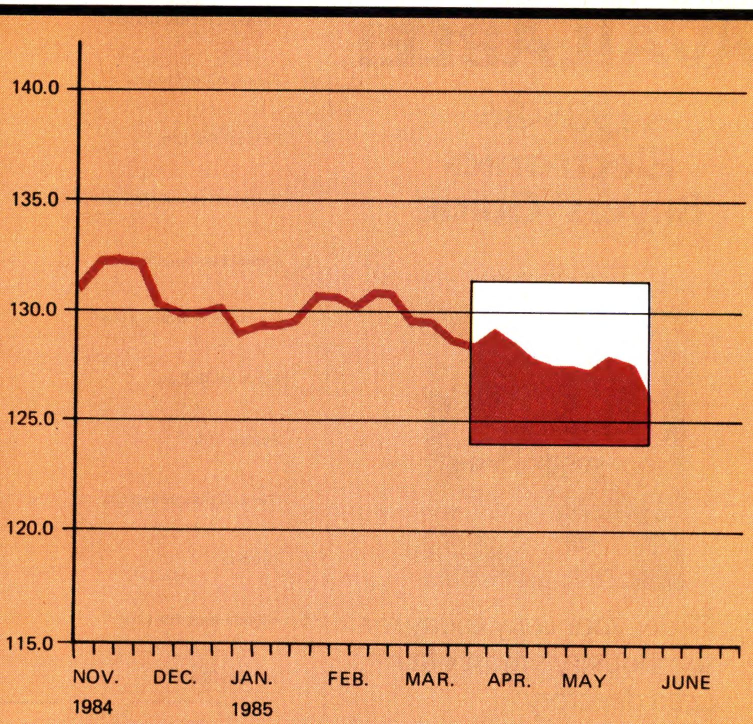
LAST WEEK = 127.4
YEAR AGO = 125.7
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

ELECTRONICS SHIPMENTS

Shipments ($ billions)	April 1985	March 1985	April 1984
Communications equipment	4.751	5.222	4.314
Radio and TV receiving equipment	0.900	0.948	0.825
Electronic and electrical instruments	4.738	4.692	4.534
Components	3.181	3.475	3.657

U.S. GENERAL ECONOMIC INDICATORS

	April 1985	March 1985	April 1984
Index of leading economic indicators	167.4	167.7	168.1
Budgeted outlays of the federal government ($ billions)	82.228	78.067	68.0687
Budgeted outlays of the Department of Defense ($ billions)	20.239	21.782	18.711
Operating rate of all industries (% capacity)	79.2	79.5	79.8
Industrial-production index	165.4	165.8	162.1
Total housing starts (annual rate in thousands)	1,913	1,883	1,949

Hit with the double whammy of reduced sales of electronics equipment and trimmed spending on national defense projects, the *ElectronicsWeek* Index fell 1.2% in the latest week. While shipments of electrical instruments edged up 1% after a small dip in March, radio and TV equipment decreased 5% and components tripped 8%. The communications industry suffered the most damage, however. Representing the largest area of electronic equipment, it declined a substantial 9%. The other half of the whammy was a 7% drop in government defense spending for April, after a steady increase earlier this year. In the coming months, further erosion of the index is possibile. With first-quarter growth for the economy limping in at a disappointing 0.7% and the leading economic indicator for April suffering a 0.2% drop-off, tough times could be lurking around the corner. However, two positives currently helping to keep business activity afloat are lower interest rates and improved consumer spending. And with belated federal income tax refunds on their way to potential spenders, consumer demand should remain decent for a while.

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	Model No.	Absolute Maximum Ratings		Electrical Characteristics								
		Collector-Emitter Voltage	Isolation Voltage	Current Transfer Ratio			Response Time				Collector Dark Current	
		V_{CEO} (V)	V_{iso} (V_{rms})	CTR (%) MIN.	I_F (mA)	V_{CE} (V)	t_r (μs) TYP.	I_C (mA)	R_L (Ω)	V_{CE} (V)	I_{CEO} (nA) MAX.	V_{CE} (V)
Single Phototransistor	PC4N25	30	2,500	20	10	10	3	2	100	10	50	10
	PC4N26		1,500		10	10						
	PC4N27		1,500	10	10	10						
	PC4N28		500		10	10					100	
	PC4N35		3,550	100	10	10	3 (t_{on})	2	100	10	50	10
	PC4N36		2,500		10	10						
	PC4N37		1,500		10	10						
Darlington Phototransistor	PC4N29	30	2,500	100	10	10	MAX. 5 (t_{on})	50	[I_F] *200 (mA)	[V_{CC}] 10 (V)	100	10
	PC4N30		1,500		10	10						
	PC4N32		2,500	500	10	10						
	PC4N33		1,500		10	10						

*t_w ≈ 1.0ms

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